TABLE S-1 / VIII-9 / X-1
KEARSARGE PUMP STATION
STORM EVENT IMPACT

Date	Flow Increase (GPM)	Adjusted Flow (GPM)	Duration		Volume
			Hrs.	Avg Q Adj.	
1-Yr. Frequency (0.9 inch/hour)					
7/30/99	1,000				
10/13/1999	1,500	1,170	6.00	546	196,000
5/18/00	2,000	1,560	3.00	1092	196,000
8/26/01	2,000	1,560	2.75	858	141,000
8/19/01	3,000	2,340	1.00	2340	140,000
8/31/01	2,200	1,700	2.00	1014	121,000
6/5/02	2,500	1,950	4.00	1170	280,000
9/14/02	2,000	1,560	4.00	546	131,000
9/27/02	3,000	2,340	4.00	546	131,000
6/21/01	2,000	1,560	-		6/21/2001
Unknown Frequency (0.35 inch/hour)					
5/18/00	800	624			
2/27/00	600	468			
9/14/02	700	550			

Note: Flow increase estimate (1-yr. vs. 0.35)
2000 - 400 = 1,600 GPM

Storage needs assumed to equal 200,000 gallons. The high figure was dropped but no adjustment was made for a .35 inch storm's storage needs.

kearsargepsstormeventimpact.xl

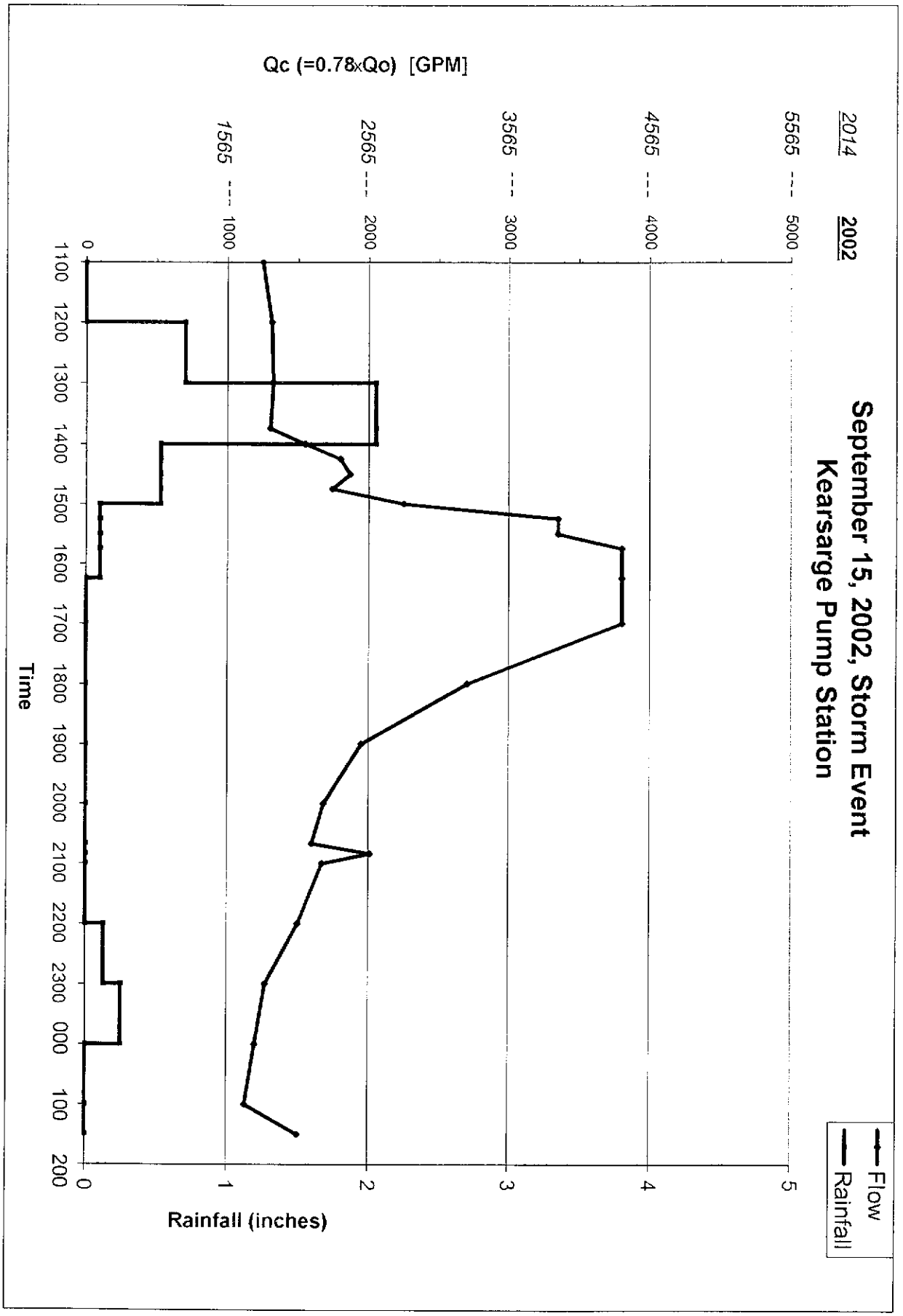


Figure S-a / VIII-i / X-c

TABLE S-2 / VIII-7 / X-3
OVERFLOW DAY'S PRECIPITATION
(inches)

Date	60 Min.	120 Min.	180 Min.	24 Hr.	Previous 2 Weeks	
12/30/92				1.20	0.73	Temp 45° **
9/17/96	0.72	0.86	0.92	3.67	4.40	
2/27/97	0.31	0.53	0.75	1.47	0.93	Thunderstorms - Rain
1/08/98	0.13	0.20	0.23	0.45	*2.08	Rain (some snow)
12/14/99	0.34	0.61	0.75	0.94	1.06	
8/23/00	1.03	1.93	1.95	3.14	2.24	Thunderstorms
11/7/00	0	0	0	0	1.67	No Comments
2/01/02	0.30	0.53	0.81	1.19	2.33	
4/14/02	0.54	0.73	0.78	0.88	2.43	
9/29/03	0.33	0.62	0.76	1.10	4.02	
11/28/03	0.15	0.29	0.40	0.95	1.02	Rain, snow
*** 3/20/04	0.26	0.29	0.29	0.46	0.59	Thunderstorms

* Previous week
** Above freezing previous 2 days & below freezing prior 5 days
*** From City meters (NOAA unedited total = .41 inches

overflowday'sprecipitation(inches)kearsargeps.xl

TABLE S-3 / IX-1 / X-2
MAXIMUM FLOW ESTIMATE
KEARSARGE PUMP STATION

Source	10-Year Flow Increase MGD	GPM	Ultimate Flow Increase MGD	GPM
Existing Flows		[1.] 4,800		5,240
Millcreek Flows [2.]	0.17	120	0.192	133
Summit Flows[2.]	0.462	320	1.142	800
Sub-Total		5,240		6,173
Contingency Flows[3.] (1-Yr. Frequency)		1,600		1,600
		6,840		7,773
Contingency Flows [4.] (20 to 100-Yr. Frequency)		2,300		2,300
		7,540		8,473

1. Based on 9/29/03 storm
2. See Chapter X
3. See Table S-1
4. Based on 9/15/02 storm

maximumflowestimatetablekearsargeps.xl

TABLE S-4 / X-4

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 4,500 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] & 2-Hr./10-Yr.
Wet Months				
Δ Storage Rate (gpm)	400 gpm	1,900 gpm	2,700 gpm	3,500 gpm
Δ Storage (2004)	180,000 gal.	380,000 gal.	720,000 gal.	650,000 gal.
Δ Storage Rate (2014)	840 gpm	2,340 gpm	3,140 gpm	3,940 gpm
Δ Storage (2014)	300,000 gal.	500,000 gal.	840,000 gal.	1,638,000 gal.
Dry Months				
Δ Storage Rate	0	0	0	600 gpm
Δ Storage	0	0	0	90,000

Assume Pump Rate at 4,500 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used.
Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements4500kearsargeps.xl

TABLE S-5 / X-5

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 5,500 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] 2-Hr./10-Yr. & 24-Hr./5-Yr.
Wet Months				
Δ Storage Rate (gpm)	0 (-700) gpm	800 gpm	1,600 gpm	2,500 gpm
Δ Storage (2004)	0 gal.	110,000 gal.	270,000 gal.	630,000 gal.
Δ Pump Rate (2014)	0 (-260) gpm	1,240 gpm	2,040 gpm	2,940 gpm
Δ Storage (2014)	0 gal.	160,000 gal.	400,000 gal.	882,000 gal.
Dry Months				
Δ Pump Rate	0	0	0	0 gpm
Δ Storage	0	0	0	0

Assume Pump Rate at 5,500 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used.
Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements5500kearsargeps.xl

TABLE S-6 / X-6

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 3,600 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] & 2-Hr./10-Yr.
Wet Months				
Δ Storage Rate (gpm)	1,200 gpm	2,700 gpm	3,500 gpm	4,400 gpm
Δ Storage (2004)	360,000 gal.	520,000 gal.	1,100,000 gal.	3,200,000 gal.
Δ Pump Rate (2014)	1,640 gpm	3,140 gpm	3,940 gpm	4,840 gpm
Δ Storage (2014)	605,000 gal.	765,000 gal.	1,345,000	4,150,000 gal.
Dry Months				
Δ Storage Rate	0	0	800	1,900 gpm
Δ Storage	0	0	72,000	672,000

Assume Pump Rate at 3,600 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used.
Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements3600kearsargeps.xl

The alternates for pump station expansion to accommodate 2014 flow estimates without and with the two contingency events defined above are:

A. Expand station forward pumping capacity to 4,500 gpm (an increase of 700 gpm in present peak pumping rates) and provide storage pumping of 950 gpm; 2,450 gpm; or 3,250 gpm and storage of 300,000 gallons; 500,000 gallons; or 840,000 gallons depending on the design contingency storm.

B. Expand station forward pumping capacity to 5,500 gpm (an increase of 1,700 gpm in present peak pumping rates) and provide storage pumping of 0 gpm; 1,350 gpm; or 2,150 gpm and storage of 0 gallon; 160,000 gallons; or 400,000 gallons depending on the design contingency storm. This alternate requires altering up to 1,700 feet of the force main.

C. Leave station forward pumping capacity at 3,600 gpm and provide storage pumping rate of 1,765 gpm; 3,265 gpm; or 3,965 gpm and storage of 605,000; 765,000; or 1,345,000 gallons.

D. Design for ultimate adds 933 gpm to the storage pump rate or to the forward flow and adds 300,000 gallons to the storage if not pumped forward.

Finally, it is concluded that any of the alternate facility designs above will provide sufficient forward pumping and storage capacity to address any storm event induced flows during periods of nonsoil saturated conditions through 2014.

Tributary Sewer Needs

The main interceptors of note are found on figure I-a in red. Of the three interceptors tributary to the pump station, two are and will be overloaded unless flows are abated or they are relieved. Abatement is being actively pursued but is not anticipated by this study to benefit the capacity of the sewers. The interceptors needing relief are the two serving Millcreek, the 10-inch on Zimmerly and the 18-inch paralleling Walnut Creek. Both sewers are intended to receive additional flows from Millcreek growth (86,000 gpd to the 10-inch and 282,000 gpd to the 18-inch). The interceptor capacity needs are found in Table S-7 and the flow relationships in Figure S-b.

18-inch Beaver Run Interceptor:

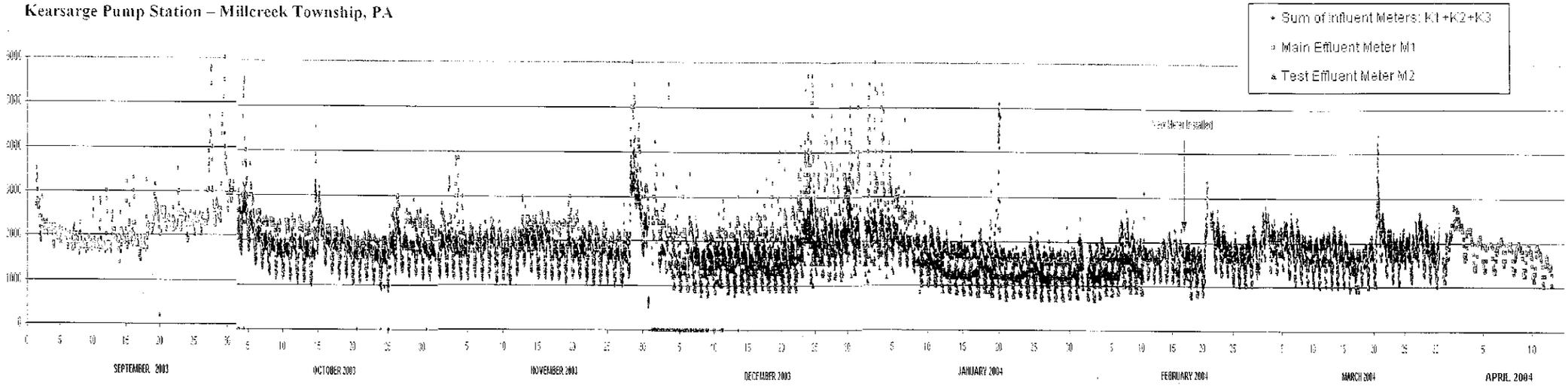
This interceptor is shown on Figure I-a as the one which parallels Walnut Creek and then Beaver Run until it crosses Peach Street. The capacity of the 18-inch over its length to Peach Street is calculated at 4.3 MGD. This sewer is anticipated to be loaded at 3,840 gpm or 5.53 MGD at the design 1-year storm. By 2014 without changes, the loading will increase to 5.81 MGD. That loading will produce a surcharge east of Peach Street in the terminal manhole of the 12-inchsewer serving the Beaver Run tributary area of approximately 8 feet or 3 feet from the surface (Figure S-c). It is proposed that this sewer be relieved by diverting flows from Kuntz Road and Route 19 south of the Walnut Creek crossing of Peach Street (includes Interchange Road and Edinboro Road). The tributary area represented by these sewers equals 40% of the

TABLE S-7 / VIII-6
TRIBUTARY INTERCEPTOR CAPACITIES

Year	Interceptor	Total (MGD)	10" (MGD)	18" (MGD)	24" (MGD)	12" (MGD)
2004	Capacity	N/A	0.65	4.30	10.00	1.08
	Base Storm Flow	6.9	1.24	4.14	1.52	0.87
	1-Yr. Storm	9.2	1.66	5.52	2.02	1.16
	25-Yr. Storm	10.2	1.84	6.12	2.24	1.35
2014	Base Storm	7.7	1.43	4.33	1.98	0.87
	1-Yr. Storm	9.8	1.85	5.64	2.48	1.16
	25-Yr. Storm	10.8	2.03	6.24	2.70	1.35
Ultimate	Base Storm	8.8	1.46	4.50	3.22	0.87
	1-Yr. Storm	11.0	1.88	5.81	3.62	1.16
	25-Yr. Storm	12.0	2.06	6.41	3.84	1.35

tributaryinterceptorcapacities.xl

INFLUENT AND EFFLUENT FLOWS vs TIME
Kearsarge Pump Station – Millcreek Township, PA



INFLUENT METER READINGS vs TIME
Kearsarge Pump Station – Millcreek Township, PA

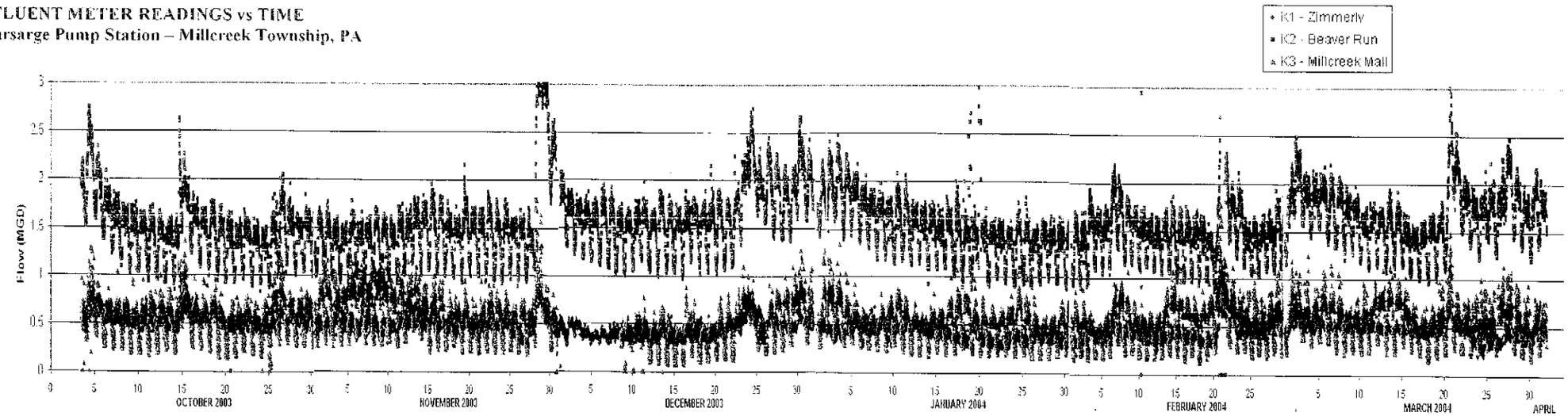


Figure S-b/VIII-

Case 1:05-cv-00059-MBC Document 38-6 Filed 03/31/2006 Page 10 of 50

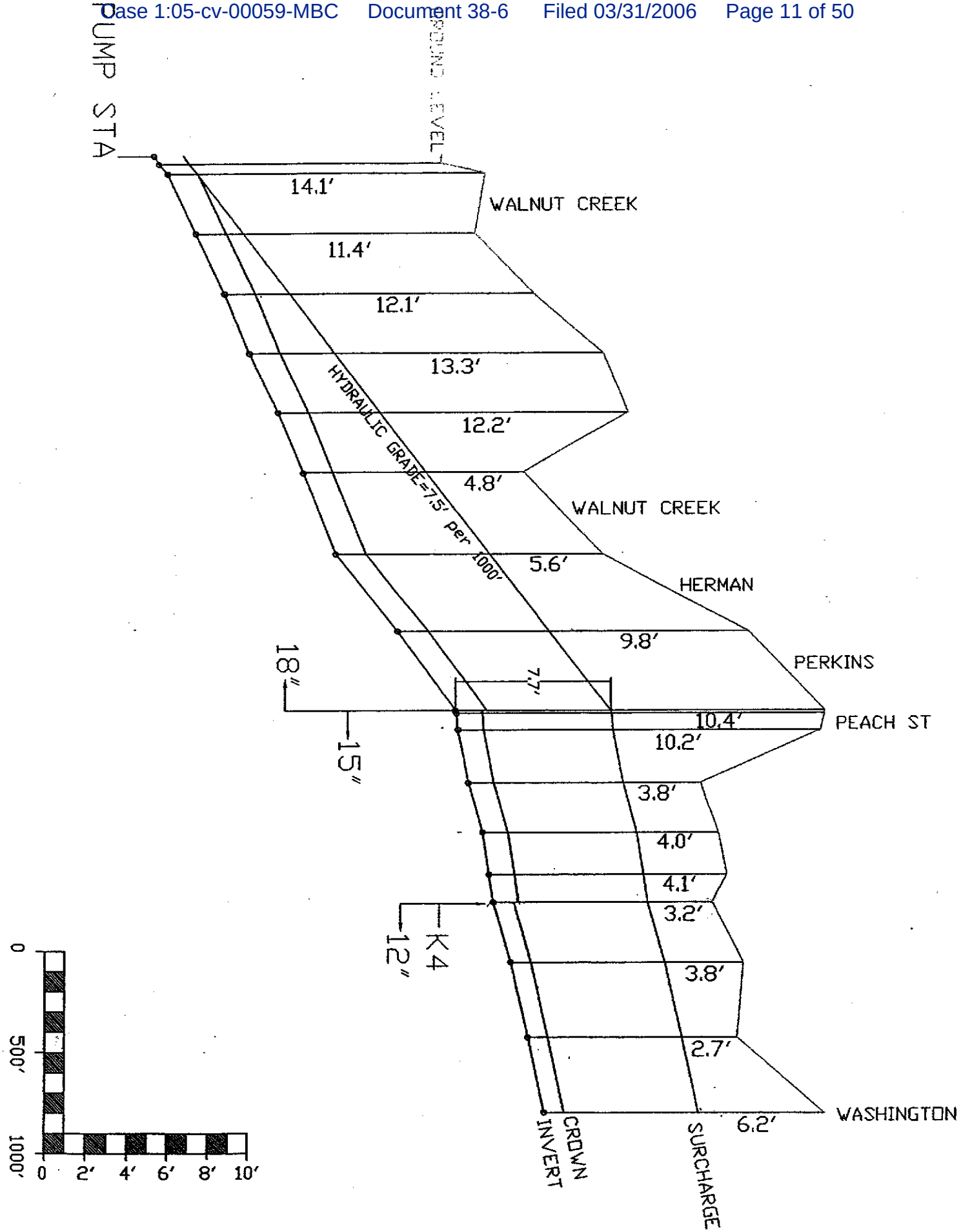


FIGURE S-c / VIII-e

MSA-MT 2164

App. 211

area tributary to the 18-inch which, if representative of the percent of flows in the 18-inch, would lower those flows to 3.5 MGD well within the sewer's capacity. The diverted flow would include all the future flows.

10-inch Zimmerly Interceptor:

This interceptor is found on Zimmerly Road. This interceptor has a capacity of 0.65 MGD and a projected ultimate flow of 1.75 MGD. The sewer needs relieved and a 15-inch relief sewer is presently under construction.

24-inch Mall Interceptor:

This interceptor parallels Walnut Creek through the mall to Route 19. This sewer has a capacity of 10.0 MGD (allowing a maximum surcharge of one foot) constructed to service Summit (5.3 MGD) and Millcreek. The projected ultimate flow from Summit is 3.9 MGD. Thus, capacity is available to divert flows.

12-inch Beaver Valley Extension:

This sewer is an extension of the Walnut Creek 18-inch interceptor serving the area of Washington Avenue and east of Washington. Its capacity is calculated at 1.08 MGD. It has been metered and determined to contribute about 21% of the 18-inch interceptor's peak flow. This equals 1.16 MGD at projected peak flows. No major development is projected for this area thus, no relief is projected for this sewer. If the surcharge imparted by the 18" is removed, any flooding should be abated. However, I&I abatement is recommended to continue to provide some safety factor since no capacity remains and problems due to blockages, etc. could create problems in the future.

Miscellaneous

If the pump station is allowed to surcharge due to some catastrophic event, it will flood to a level which will flood up to 39 houses in the Dixson Street/51st Street area before it reaches gravity relief. No homes will be flooded to the south or east. It is suggested that backflow preventers be placed on the homes which can be affected.

Although the pump station surcharge will not back up wastes sufficiently to cause flooding or overflow, it will aggravate the sewer overload impact and will allow for flooding and overflow if the sewers are allowed to remain overloaded. For every foot that the pump station surcharges above the sewer inlet inverts, a foot will be added to the surcharge indicated on Figure S-c / VIII-e.

Recommendations

Pump Station Upgrade

All proposed upgrades should be implemented. The generator replacement and automatic transfer switch should be considered early.

Pump Station Expansion

Alternate A increased pumping to 4,500 gpm with contingency for a one-year storm is recommended. This alternate is considered status quo as its capacity increase will be mostly utilized by continued growth in the service area by 2014. Any sizing should look at potential needs by then so that expansion for ultimate growth is not hampered. The alternate evaluation pages from the main text are attached here for ready reference.

Tributary Interceptor

The Peach Street interceptor flows shown in red on Figure I-a crossing Walnut Creek should be diverted to the 24-inch mall sewer at the mall entry near Sear's. This sewer's peak ultimate flows are estimated at 1.2 MGD and its diversion will significantly lessen the 18-inch Beaver Run overload.

In the event there is no additional improvement to the 18-inch flows through I&I abatement by 2014, consideration should be given to diverting the Kuntz Road interceptor (shown in red on Figure S-c) north of the Walnut Creek crossing of Peach Street to the 24-inch also. It will, however, require pumping and must connect downstream 700 ft. from the Peach Street connection.

Costs

Projected costs are found in the attached Table S-8. Costs have also been obtained for a 250,000 gallon below ground reinforced concrete tank. Use of such a tank would only result in a $158,000 saving in the price of a 500,000 gallon tank.

MSA-MT 2166

App. 213

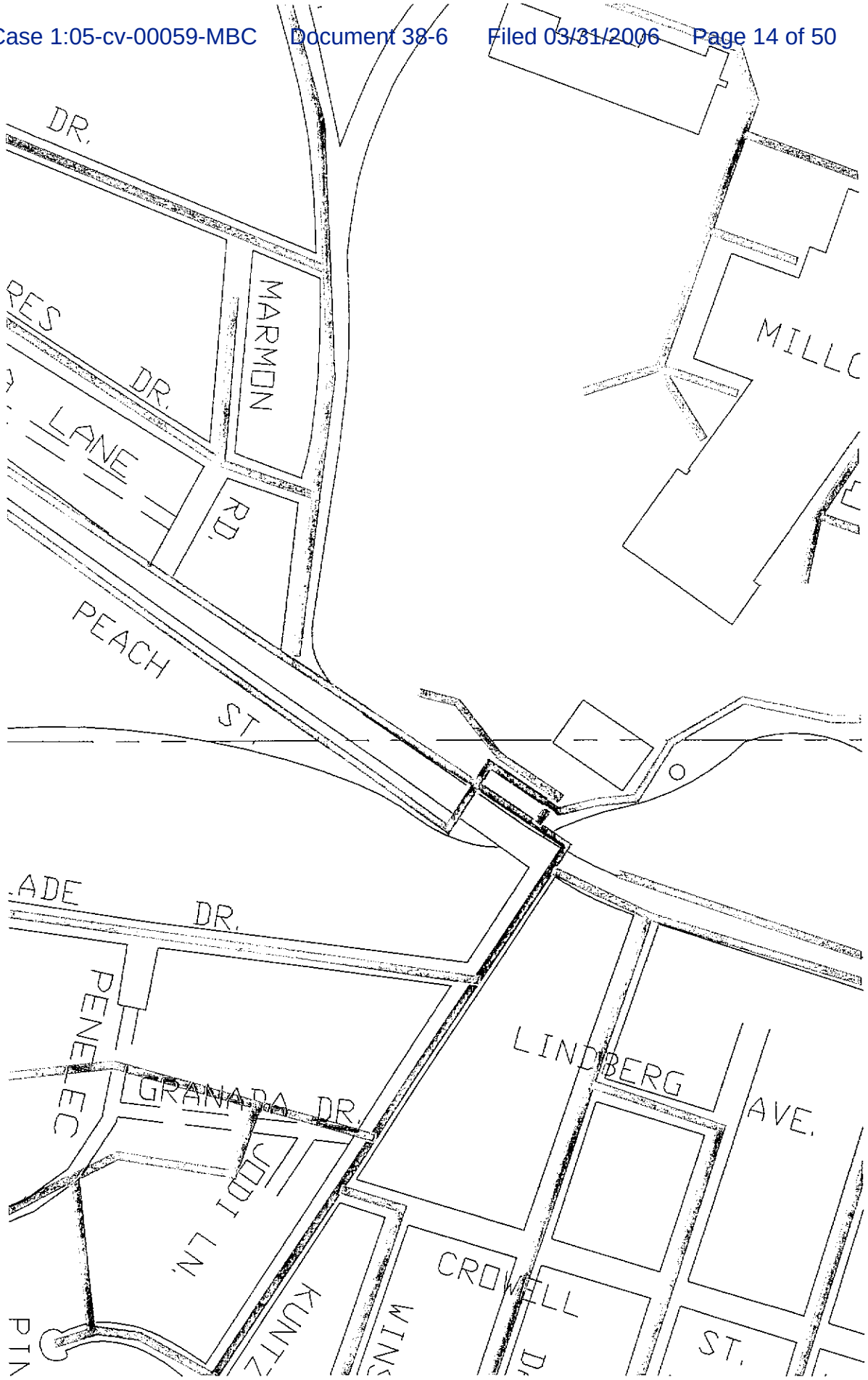

DR.
MARMON
RES
DR.
LANE
RD.
PEACH
ST
MILLC
ADE
DR.
PENELEC
GRANADA DR.
SOUTH LN.
KUNTZ
WINS
CROWELL
LINDBERG
AVE.
ST.

FIGURE S-d

TABLE S-8 / XI-1
OPINION OF PROBABLE CONSTRUCTION COSTS
MILLCREEK TOWNSHIP SEWER AUTHORITY
KEARSARGE PUMP STATION

PHASE	ITEM	COST ESTIMATE				
		PHASE 1	**PHASE 2**			
			ABOVEGROUND		BELOWGROUND	BELOWGROUND
			CAISSONS	SPREAD		
			500,000 gal.	500,000 gal.	500,000 gal.	1,000,000 gal.
1	Pump/Shaft/Motor (3)	$150,000				
	Variable Frequency Drives (1) (150 hp)	$15,000				
	Generator (Gas)	$160,000				
	SCADA	$25,000				
	Monitoring Equipment	$20,000				
	Odor Control	$210,000				
	SubTotal Phase 1	$580,000				
2	ORF Tank		$400,000	$400,000	$580,000	$780,000
	ORF Foundation		$550,000	$100,000	$550,000	$750,000
	ORF Pump Station Pumps					
	ORF Pump Station Controls					
	ORF Pump Station Piping		$300,000	$300,000	$300,000	$300,000
	ORF Pump Station Valves					
	ORF Pump Station Structure					
	SubTotal Phase 2		$1,250,000	$800,000	$1,430,000	$1,830,000
	Contingency (30%)	$170,000	$380,000	$240,000	$430,000	$550,000
	TOTAL	$750,000	$1,630,000	$1,040,000	$1,860,000	$2,380,000

OPINION OF TOTAL PROJECT COSTS

	PHASE 1 & 2			
	ABOVEGROUND TANK		BELOW GROUND TANK	
	CAISSONS	SPREAD	500,000	1,000,000
Construction Cost	2,380,000	1,790,000	2,610,000	3,130,000
Engineering Cost	500,000	360,000	540,000	620,000
TOTAL	2,880,000	2,150,000	3,150,000	3,750,000

opconstructioncostskearsargepstableS-8.xl

ALTERNATE EVALUATION

Pump Station

The three alternates, available for immediate construction, pros and cons are presented in the following paragraphs.

Alternate A - Minimize pumping and storage requirements

Effort:

- Replace three pumps with 4,500 gpm units
- Construct storage pumping station
- Construct storage tank

Pro's:

- Will manage and both pass and store peak flows and additional growth through 2014
- With experience mag divert lesser peaks to storage thus lowering City peaks
- Will minimize peak flows observed downstream by shaving peaks
- Will allow for consideration of contingency events due to commingling of storm events by increasing size of planned facilities (storage pumping and tank)
- Will provide additional duplication to protect against flows which may be unanticipated due to severe weather (i.e. two duplicate pumps, emergency overflow to storage, etc.)
- Will allow for pumping increase as an alternate to storage in 2014 in addition to storage
- Pump variable speed range just covers low and high flow observations

Con's:

- High cost
- Esthetics – odors and visual
- Benefits for successful I&I abatement least
- Ultimate flow alternatives will need to look at repetitious construction

Alternate B – Maximize Forward Pumping

Effort:

- Replace three pumps with 5,500 gpm units
- Reconstruct force main
- Storage for contingencies only

Pro's:

- Will manage and pass existing observed peak flows (warm and cold seasonal) plus additional growth through 2014
- No storage required for base storm event thus minimizing esthetic problems and operational problems associated with such units
- Least cost
- Allows time to assess impact of I&I abatement
- Will meet 10 State Standards

Con's:

- Does not provide for contingency flows associated with commingling of storm events
- Providing for contingency events will require storage minimizing cost savings
- Pumps will pass 1,700 gpm (2.5 MGD) more flow than previously accomplished (with surcharged wet well) to the City further compounding agreement violations
- Will require off site construction to on large force main
- Limited response to unanticipated peak flow responses to severe weather events
- Pump variable speed flow range will not accommodate both minimum and maximum flows

Alternate C – Maximize Storage

Effort:

- Replace pump #3 with one of equal capacity to pumps #1 and #2
- Construct storage pumping
- Construct storage tank

Pro's:

- Does not impact forward flows or City agreement
- Allows for future ultimate flow to be managed by increased pumping only
- Allows for consideration of contingency events by increasing size of planned facilities

- Pumping range is well established as being optimum
- Least amount of pump station modifications
- Operating costs minimized (charges)
- Station emergency forward capacity will be marginally improved with larger #3 pump
- Allows benefits of successful I&I to be applied to units affecting operating costs

Cons's:

- Storage only, no duplication, least flexible
- Largest cost
- Largest negative esthetic impact

It is not believed that the concerns of the Authority, the PA DEP, and concerned citizenry will be met if plans are not made for an overlap of peak storm events resulting in higher flows being impassed on the base peak flow event. Thus, it is believed that storage will be required regardless of the forward pumping alternate selected.

ACT 537
SPECIAL STUDY

MILLCREEK TOWNSHIP SEWER AUTHORITY / MILLCREEK TOWNSHIP

KEARSARGE PUMP STATION

I. PLAN SUMMARY

I-a Proposed Service Areas & Major Problems

The Kearsarge pump station services the south central portion of Millcreek Township and the western half of Summit Township, including the Rt. 19/Peach Street commercial corridor, a large commercial and recreational district, including many major water users such as motels and restaurants. The service area is shown on Figure I-a.

The Kearsarge pump station has a history of overflow at a frequency of about once per year since 1992. The overflows are symptomatic of high water tables or saturated soils in combination with high frequency or low intensity storms. Fully eight of the twelve overflow events have occurred during the period December through April where atmospheric conditions encourage saturated soils (low evaporation and transpiration and frozen or frost impaired percolations) and discourage high intensity storms. All overflows that have been observed are associated with wet conditions and only one event has been associated with rainfall events with frequencies of one year or less. The problem is to identify the flow rates and volumes tributary to the station under various storm scenarios and to provide for potential rain events not yet experienced during periods favorable for peak sewer contributions and future flows from continuing growth while minimizing pumped forward flows.

A second problem is associated with the surcharge of sewers in the tributary areas which have led to the need to pump from manholes to lower the sewer hydraulic flow line to prevent basement flooding. Problems which may be due to inadequate sewer capacity as well as pump station overloads.

I-b Identify Selected Plan

The selected alternative includes improving the pump station reliability, increasing its forward pumping capacity to accept future growth flows, providing storage to retain infiltration/inflow induced flows above the forward pumping capacity, providing influent relief sewers and diversions to relieve surcharges and continuing the I&I abatement programs.

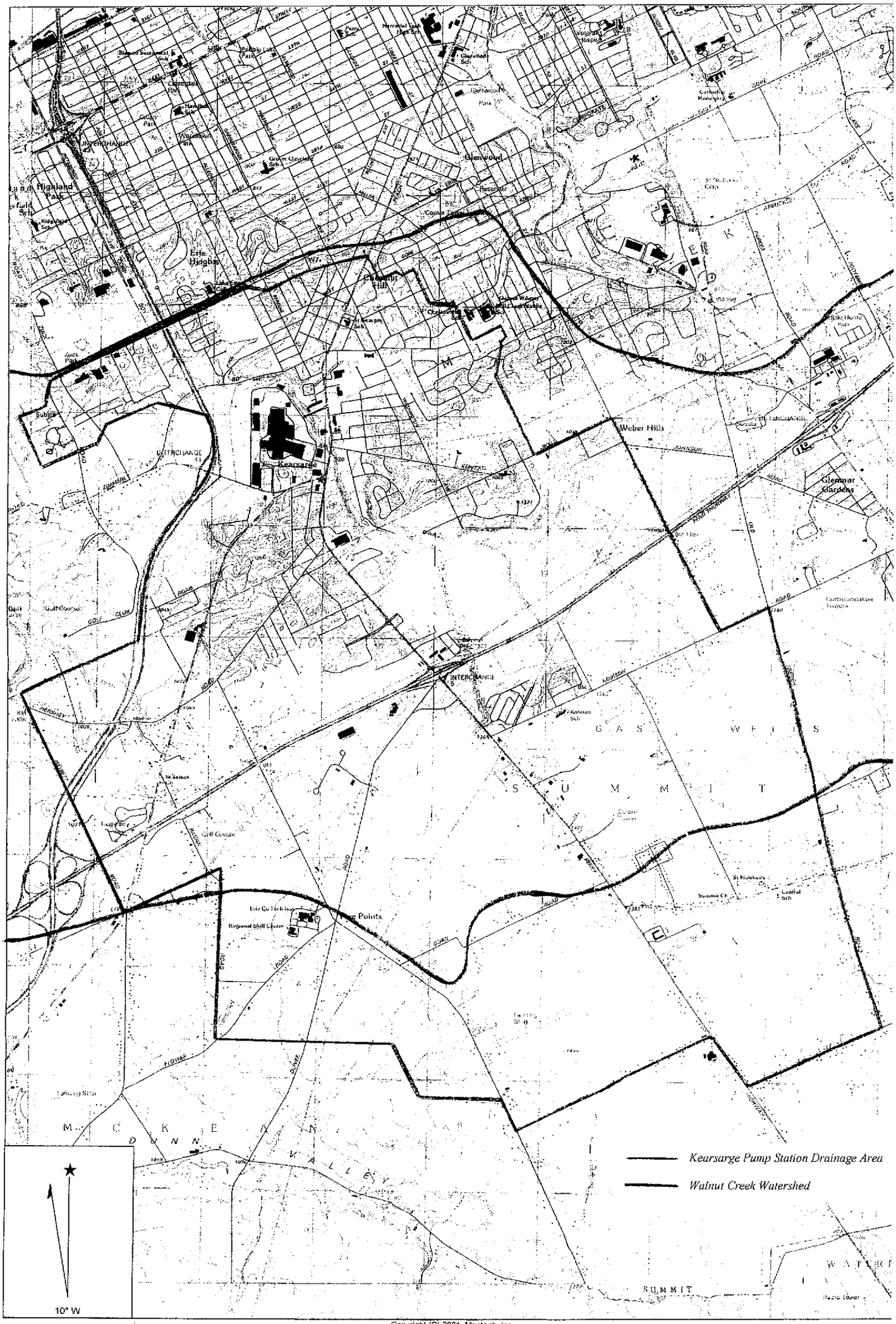


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Figure I-a / VI-a

MSA-MT 2173

I-c Estimated Costs & Funding Proposals

Estimated costs for the pump station upgrade and upsizing are found in the following table.

TABLE S-8
OPINION OF PROBABLE CONSTRUCTION COSTS
MILLCREEK TOWNSHIP SEWER AUTHORITY
KEARSARGE PUMP STATION

PHASE	ITEM	COST ESTIMATE				
		PHASE 1	PHASE 2			
			ABOVEGROUND		BELOWGROUND	BELOWGROUND
			CAISSONS 500,000 gal.	SPREAD 500,000 gal.	500,000 gal.	1,000,000 gal.
1	Pump/Shaft/Motor (3)	$150,000				
	Variable Frequency Drives (1) (150 hp)	$15,000				
	Generator (Gas)	$160,000				
	SCADA	$25,000				
	Monitoring Equipment	$20,000				
	Odor Control	$210,000				
	SubTotal Phase 1	$580,000				
2	ORF Tank		$400,000	$400,000	$580,000	$780,000
	ORF Foundation		$550,000	$100,000	$550,000	$750,000
	ORF Pump Station Pumps					
	ORF Pump Station Controls					
	ORF Pump Station Piping		$300,000	$300,000	$300,000	$300,000
	ORF Pump Station Valves					
	ORF Pump Station Structure					
	SubTotal Phase 2		$1,250,000	$800,000	$1,430,000	$1,830,000
	Contingency (30%)	$170,000	$385,000	$240,000	$420,000	$550,000
	TOTAL	$750,000	$1,630,000	$1,040,000	$1,860,000	$2,380,000

OPINION OF TOTAL PROJECT COSTS

	PHASE 1 & 2			
	ABOVEGROUND TANK		BELOW GROUND TANK	
	CAISSONS	SPREAD	500,000	1,000,000
Construction Cost	2,380,000	1,790,000	2,610,000	3,130,000
Engineering Cost	500,000	360,000	540,000	620,000
TOTAL	2,880,000	2,150,000	3,150,000	3,750,000

The Millcreek Township Sewer Authority has elected to pursue an alternate utilizing an aboveground tank. Financing is intended to be accomplished through a bond issue and cost sharing between Millcreek and Summit in proportion to contributing peak flows presently estimated at 73% Millcreek and 27% Summit.

Annual payments are estimated based on a 20-year issue financed at 5% at between $172,000 and $230,000 depending on construction requirements. The user fees are projected to equal between $1.10 and $1.47 per quarter for Millcreek and $4.53 and $6.06 for Summit.

I-d Municipal Commitments

Formal adoption of the plan has been obtained from the Millcreek Township supervisors and the Summit Township supervisors. Both Sewer Authorities have committed to the implementation.

I-e Implementation Schedule

The implementation schedule is defined in the Consent Agreement and is repeated here

- Adoption of Act 537 Special Study, June 30, 2004
- Submission to the PA DEP, July 1, 2004
- Approval by the PA DEP
- Design of Needed Improvement and submittal of Part II permit application and any other required permit application or information, 9 months after approval
- PA DEP permit
- Complete Construction, 18 months after permit issuance
- Remove overflow and eliminate overflow events tributary to the Kearsarge pump station, 30 days after construction complete
- Initiate feasibility study for expansion of Kearsarge pump station for ultimate flow; diversion of Kuntz Road sewer; and construction of a relief sewer for Interchange Road: 2012 (or as needed).

II. MUNICIPALITY RESOLUTIONS

The resolutions adopting the plan are attached and included in Appendix A-1.

- Millcreek Township
- Millcreek Township Sewer Authority
- Summit Township
- Summit Township Sewer Authority

OATH of PUBLICATION
In
THE ERIE TIMES-NEWS
COMBINATION EDITION

MILLCREEK TWP SEWER AUTHORITY
3608 WEST 26TH STREET
ERIE PA 16506-2037

REFERENCE: L0002200
0000508184 PUBLICADVERTISEMENTT

STATE OF PENNSYLVANIA)
COUNTY OF ERIE) SS:

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PUBLIC ADVERTISEMENT

THE Millcreek Township Sewer Authority, Millcreek, Erie County, Pennsylvania is providing a thirty (30) day period for public comment on a Special Study Supplementing the township's Act 537 Sewage Facilities Plan covering the Kearsarge Pump Station Upgrade.

The purpose of this special Study is to define the facilities necessary to provide capacity to eliminate existing and future station overloads. The study includes facilities sizing, cost estimates, proposed funding, user charges, implementation schedule and environmental review documentation.

The comment period shall extend from May 26, 2004, to June 25, 2004. The document is an office copy and will be on display for public review at the Millcreek Township Sewer Authority and Millcreek Township offices at the Municipal Building at 3608 West 26th Street, Erie, PA 16506 and at the Summit Township Sewer Authority, Building at 8896 Old French Road, Erie, PA 16509.

Please direct comments and questions pertaining to said document in writing to the Millcreek Township Sewer Authority, 3608 West 26th Street, Erie, PA 16506 or Conboer Townsend Envirodyne Engineers, 155 West 8th Street, Suite 418, Erie, PA 16501 on or before June 25, 2004.

George Riedesel, P.E.
Manager
Millcreek Township Sewer Authority
(5-508184-NT-26)

Sworn to and subscribed before me this
26th day of May 2004 Affiant: James E. Dible

NOTARY: Marycath Swoger

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Marycath Swoger, Notary Public
City Of Erie, Erie County
My Commission Expires Oct. 6, 2007
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III. PLANNING AGENCY COMMENTS

The Erie County Department of Planning has comments by letter of June 9, 2004, that the plan is generally consistent with the Erie County Plan (Appendix A-1). PNDI and the PA Historical & Museum Commission have commented there are no impacts on threatened, endangered or rare species or historic and archaeological resources (Appendix A-1).

IV. PUBLIC NOTICE & COMMENTS

The Public Notice is attached and included in Appendix A-2. Both verbal and written comments have been received from the Millcreek Township Sewer Authority (Alternate Costs); Millcreek Township supervisors (Environmental Impact, Alternate Costs, and I&I abatement impacts on design flows); Summit Township Sewer Authority (Alternate Costs, Rt. 99 Sewer capacity, flow metering, future flows, peak flow interpretations, Summit supervisors sewer repair cost sharing); and the PA DEP. The comments are found in Appendix A-2 along with the responses or the plan change where it was necessitated.

V. PREVIOUS WASTEWATER PLANNING

A. Millcreek Township's Existing Act 537 Plan – 1996

This plan addresses problems throughout the township including several directly impacting the Kearsarge pump station. Specifically they included:

1. Increasing capacity of the Manor Drive interceptor and Pittsburgh Avenue interceptors to accept future flows including those from the Kearsarge pump station (complete).

2. Implementing I&I abatement in the Kearsarge tributary area to minimize station expansion requirements. Abatement proposals included:

    a) Construction of storm water detention to minimize flooding (complete).
    b) I&I surveys and abatements to lessen flows to receiving sewers and Kearsarge pump station (continuing).

3. Upgrade Kearsarge pump station as needed to accommodate existing and future peak flows (incomplete but anticipated).

B. Erie City Act 537 Plan – 1996

This plan addressed Erie City and Authority interceptor sewer upgrades to accept future municipal flows. It utilized proposed municipal flows to establish design criteria for

interceptor sewer upgrades and relief throughout the City to the wastewater treatment plant. The agreement between the City and the municipalities did not set limits for individual sources within the township, only for flows at the connection point. The connection point accepting Kearsarge flows is the Manor Drive connection. Its agreement limits are:

Millcreek:	23.27 MGD
Summit:	3.90 MGD
Fairview:	3.33 MGD

Millcreek's calculations of flow contributions (which were not incorporated into the City's Act 537) included 14.3 MGD (9,930 gpm) from Kearsarge pump station including Summit and Millcreek flows.

C. Millcreek Township Comprehensive Plan 2002

In 2002, Millcreek Township adopted the Millcreek Township Comprehensive Plan, based on Pennsylvania's Municipalities Planning Code, as a guidance tool for future development within township boundaries. The document provides township plans on housing, cultural and historical preservation, open space preservation, future land use, and economic development. In addition, the plan also provides guidance on pollution prevention through the public utilities and non-point source water pollution plans. The recommendations that are pertinent to the current Act 537 planning process are that the township should:

a) discourage the use of on-site wells and sewage disposal systems where public sewer service is available;

b) develop a water and sewer maintenance program focusing on rehabilitating and replacing older, deteriorating lines and supplying new water and sewer lines to areas inevitable for development;

c) consider expanding sewer and waterlines to those areas that have no such service presently or that could be developed in the near future.

D. Township Zoning Ordinance

The Zoning Ordinance of Millcreek Township was enacted on December 30, 1974. The ordinance includes general zoning restrictions on new development of residential, commercial, and industrial land uses, including requirements for dwelling sizes, available parking, and yard setbacks. The ordinance also includes general requirements for a Zoning Hearing Board and a Planning Commission. In addition, the ordinance designates that the township is to be divided into fifteen (15) use districts as established on the

official zoning map for Millcreek Township. A map showing zoning districts within the study area is contained in Appendix I.

E. Floodplain Regulation & FEMA Floodplain Mapping

Millcreek Township regulates construction activities within the FEMA designated floodplain through the Millcreek Zoning Department.

Floodplain maps for the planning area are provided in Appendix B-1.

F. Stormwater Management

Currently, all new construction in Millcreek Township is regulated under the Millcreek Township Stormwater Management Ordinance (Ordinance 97-4), enacted under the authority of Act 167 (The Pennsylvania Stormwater Management Act) and Millcreek Township Subdivision Ordinance 65-1.

The ordinances require new developments to provide complete drainage plans and roof, sump and French drains to the storm sewer or natural drainage system. In addition, the township's regulations make it unlawful to make a connection to the sanitary sewer for the purpose of discharging stormwater.

G. Millcreek Township Sewer Authority – Act 537 Sewage Facilities Draft Plan December 2003

This plan is being prepared for the remaining areas of Millcreek Township (not Kearsarge). It promotes the extension of sewers into all undeveloped areas and developed areas not yet served by sewers.

The plan contribution to this plan is limited to its population projections for the township (Table12) and its projected future contributions to the Manor connection (now subdivided into the Pittsburgh and the Manor connection) from areas of Millcreek other than the Kearsarge area. Total of those connections equal 956 EDU's of which 148 are projected to the Pittsburgh leg to which Kearsarge is tributary. The City/Township agreement does not discern between the two subdivisions, just the total. Total projected peak future incremental flows to Manor/Pittsburgh other than Kearsarge equals 583,600 gpd.

The population data used for the draft plan was taken from the PA DEP's census and projection data and is found in the following table.

POPULATION DATA FOR
CONTRIBUTING TOWNSHIPS

Year	Summit *	Millcreek Township
1970 Census	4,237	36,980
1980 Census	5,381	44,303
1990 Census	5,284	46,820
2000 Census	5,529	52,121
2010 Estimate	5,774	55,331
2020 Estimate	5,876	58,571
2030 Estimate	5,898	60,892
2040 Estimate	5,894	62,844

* Only a portion of this population currently discharges sewage to the MTSA sewage conveyance system.

Source: Population census and projection data provided by the PA DEP

H. Summit Township Sewer Authority Facilities Plan – 1981

This plan called for servicing areas of Summit tributary to Rt. 19 corridor into Millcreek and to the Erie Wastewater Treatment Plant.

I. Summit Township Master Plan (1987)

This plan, while adopted only by the Summit Township Sewer Authority (STSA), calls for servicing all future development in Summit Township north of Lee Road and west of Old French Road and Cherry to the Kearsarge pump station. Development tributary to Rt. 99 or Edinboro Road would utilize the MTSA's Rt. 99 sewer while the development east of Hamot Road would utilize Summit's Rt. 19 sewer (Appendix B-2).

J. Summit Disposal Needs Assessment – 2004 – While not yet final, this study defines the homes in Summit Township needing sewers to relieve malfunctioning septic tanks.

K. Water Quality Manage Plan for the Lake Erie Area – September 1976

This plan studied all of Erie County and the Lake Erie drainage basin in Pennsylvania. It projected the Erie City WWTP service area extending into Summit Township south to the approximate boundaries of the Lake Erie drainage basin (Zwilling Road). All of Millcreek Township is found in the City's service boundaries.

L. Erie City/Millcreek Township Treatment Agreement

This agreement requires Millcreek to transport all its domestic wastewater for treatment to the Erie WWTP and required the City to provide capacity for that flow at the expense of Millcreek.

K. Millcreek Township / Summit Township Sewage Transportation Agreement 1994

This agreement defines cost sharing and capacity sharing in the joint transportation network (Appendix B-3).

VI. PHYSICAL & DEMOGRAPHIC ANALYSIS

VI-a Planning Area

The planning area is described on the map entitled Figure I-a / VI-a. The planning area consists of approximately 1,700 acres in Millcreek and 7,200 acres in Summit. The areas in Millcreek are located south of the City and between Old Zuck Road (on the west) and Clinton Street on the east (excludes an area north and west of I-79 and south of Village Common Drive). The Summit areas are west of Cherry Street and north of Lee Road.

The MTSA currently serves all but an estimated 75 EDU's in its service area and proposes serving all. Summit does not propose serving all its existing residences and proposes to continue the use of an onlot disposal for its remote population.

VI-b Physical Characteristics

The service area is located between two east/west ridges making up the Walnut Creek Valley. The northern ridge is the Erie City/Millcreek boundary and the southern ridge is located in Summit (Figure I-a / VI-a and separates the Lake Erie drainage basin from the Mississippi basin. In this area Walnut Creek meanders first north out of Summit then westerly until it departs the service area. Its main tributary is Beaver Run which enters Walnut Creek just west of Rt. 19. Beaver Run drains most of the area in Millcreek west of Rt. 19 to Clinton Street.

The land slopes relatively gently from the two ridges toward Walnut Creek and its tributaries. Sewage flow generally follows the natural topography to the Kearsarge

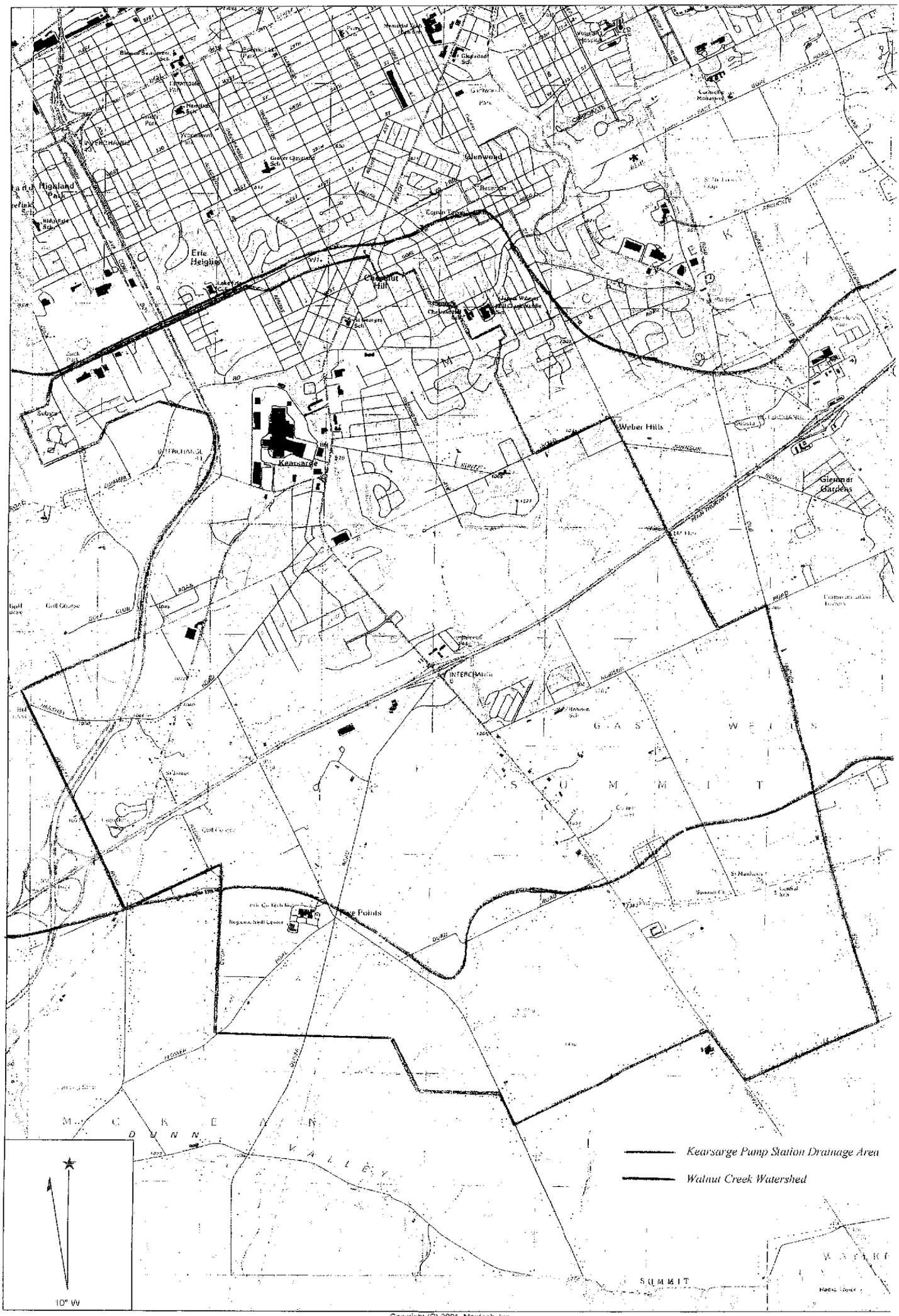

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Figure I-a / VI-

MSA-MT 2182

pump station located adjacent to Walnut Creek. The pump station pumps the gathered flow northward out of the Walnut Creek Valley and over the northern ridge. From there it flows north and east to the Erie WWTP. The water shed boundaries are also found on Figure I-a/VI-a.

VI-c Soils

The majority of soils in the study area vary from silty and clay soils in the valley floor (Platea and Birdsall) to deep medium textured soils on the ridges upland slopes (Erie, Ellery, Alden and Langford) (see Soils Map in Appendix B-4). Of the soils only Langford offers a consistent possibility of being acceptable for subsurface disposal and then only using mound systems. Because of these and the inclusions of better soils common to glaciated areas, there are potential sites approvable for subsurface disposal in Summit's portion of the drainage area.

The soils in the valley floor of Birdsall and Platea are characterized by high seasonal water tables (within 8-inches to 10-inches of the surface) leaving little room for storage of precipitation during the high water table season (December through April).

There is a significant number of conotton soils located in the developed area east of Washington and north of Beaver Run. These soils are a gravelly sandy loam with a seasonal water table at 28-inches to 33-inches. These soils will allow waters to move rapidly and, when downward motion is inhibited by the seasonal water table, the waters can move laterally relatively easily until intercepted by obstructions such as foundations.

Prime agricultural soils are not common in the study area. A pocket which does exist in Millcreek is now covered by the mall. They do exist in Summit Township south and east of the study area primarily in the Mississippi River drainage basin.

VII. EXISTING SEWAGE FACILITIES IN THE KEARSARGE PUMP STATION TRIBUTARY SEWER SYSTEM

A. Kearsarge Pump Station Tributary Sewer System

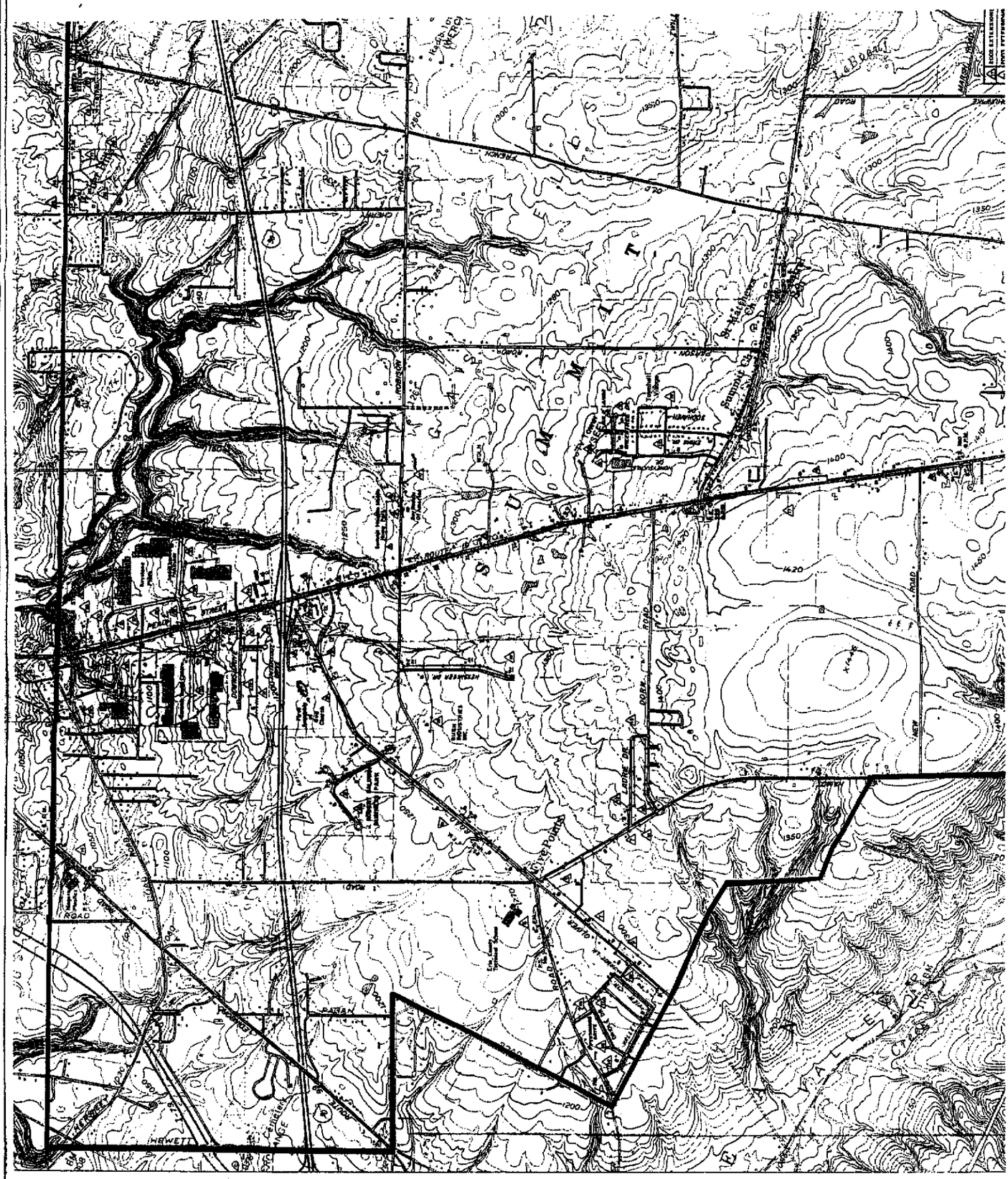
The Millcreek Township and Summit Township Sewer Authorities' sewer systems tributary to the Kearsarge pump station are described in Figures VII-1 and VII-2. Since this Special Study is limited to the Kearsarge pump station and its tributary interceptor sewers' capacity problems, the remainder of the existing system will not be described in any more detail.

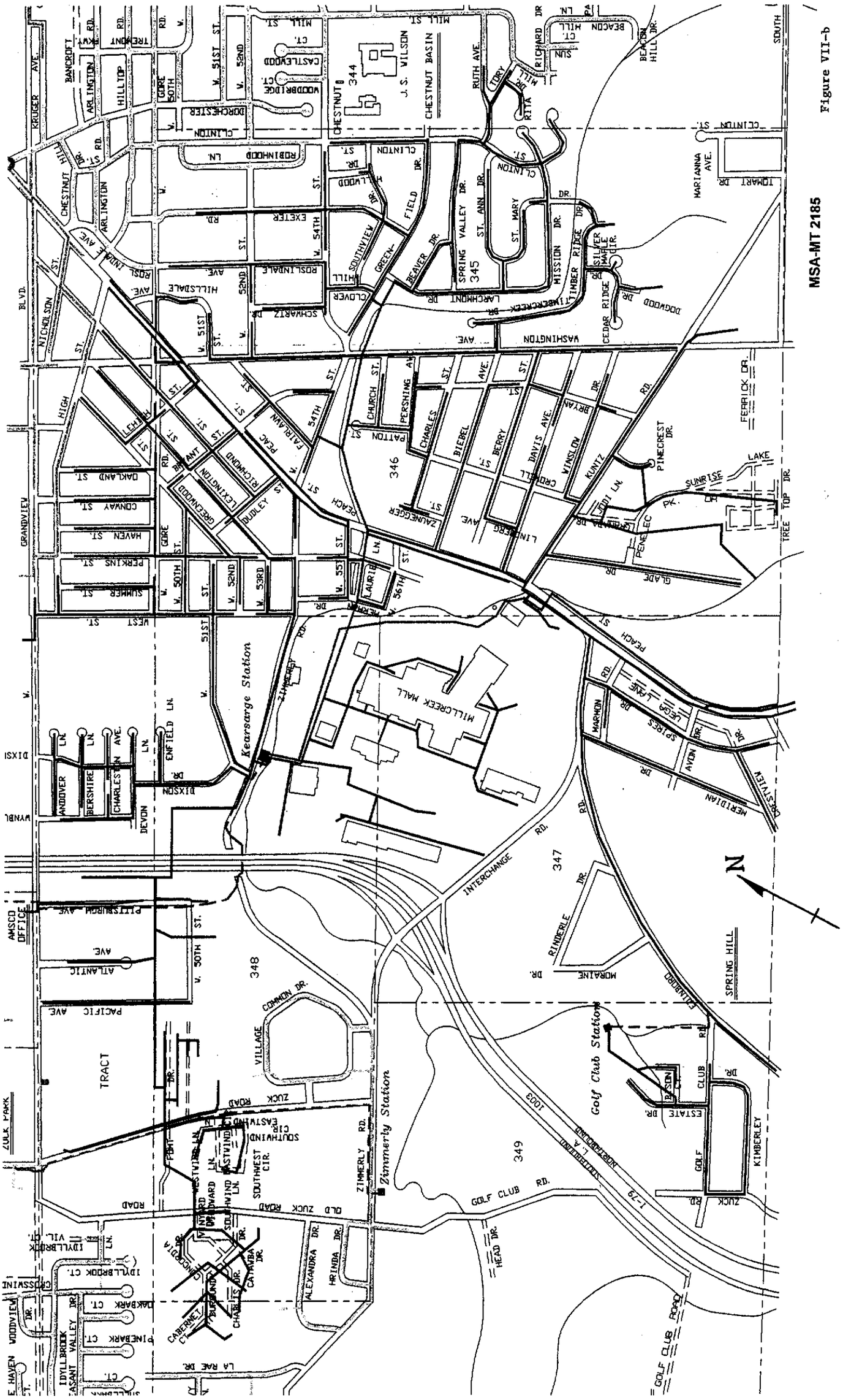
B. Onlot Surveys

The MTSA has completed onlot surveys of developed areas within the Kearsarge tributary system which are reported on in the December draft of the proposed update of their "Act 537 Sewage Facilities Plan." The results are found in Appendix B-2 of that

Figure VII-a

MSA-MT 2184




Kearsarge Station
Zimmerly Station
Golf Club Station
TRACT
VILLAGE
MILLCREEK MALL
J. S. WILSON
CHESTNUT BASIN
SPRING VALLEY DR.
ST. ANN DR.
ST. MARY
MISSION DR.
TIMBER RIDGE
SILVER MAPLE DR.
CEDAR RIDGE DR.
DOGWOOD DR.
LARCHMONT DR.
TIMBERCREEK DR.
BEAVER DR.
FIELD DR.
SOUTHVIEW HILL
GREEN
CLOVER
ROSLINDALE AVE.
HILLSDALE AVE.
SCHWARTZ DR.
CLINTON ST.
CHESTNUT ST.
HILLTOP
ARLINGTON
BANCROFT
KRUGER AVE.
NICHOLSON BLVD.
GRANDVIEW
HIGH
DIXSI
WYNDL
DEVON
ANDOVER
BERKSHIRE
CHARLESTON
ENFIELD LN.
DIXSON DR.
PITTSBURGH AVE.
ATLANTIC AVE.
PACIFIC AVE
AMSCO OFFICE
ZULK PARK
COMMON DR.
ZUCK ROAD
OLD ZUCK ROAD
ZIMMERLY RD.
GOLF CLUB RD.
INTERCHANGE RD.
I-79
NORTHBOUND
SOUTHBOUND
SPRING HILL
MORAINE DR.
RIMBERLE DR.
MERIDIAN
CASSIDY
LEGA LANE
SPICES
MARMON DR.
AVON DR.
PEACH ST.
ZIMMERLY
LAURIE LN.
W. 55TH
W. 53RD
W. 52ND
W. 50TH
W. 51ST ST.
W. 54TH
W. 52ND
W. 51ST
SUMMER
PERKINS
HAVEN
CONWAY
OAKLAND
GREENWOOD
LEXINGTON
RICHMOND
FAIRLAWN
PEACH
DUDLEY
BRYANT
LEWIS
CHURCH ST.
PERSHING AVE.
PATTON ST.
CHARLES
BIEBEL
BERRY
DAVIS AVE.
WINSLOW
CROWELL
BRYAN
KUNTZ
ZAUNEGGER AVE.
LINDBERG
PINECREST DR.
SUNRISE DR.
LAKE
TREE TOP DR.
FERRICK DR.
GLADE DR.
PENELEC
MARIANNA AVE.
TOMARI DR.
CLINTON ST.
BEACON HILL DR.
BEACON HILL CT.
RICHARD DR.
RITA
RUTH AVE.
MILL ST.
DRY
WASHINGTON AVE.
RODINHOOD LN.
DORCHESTER
CASTLEWOOD CT.
WOODBRIDGE CT.
GORE
SOUTH
344
345
346
347
348
349
N
MSA-MT 2185
Figure VII-b
App. 232

report under Study Area 2 (found in Appendix B-2) and the numbers are reflected in the design population used in this report.

Summit Township likewise has completed onlot surveys (Appendix B-2) and estimates sewer service will be needed for up to 283 EDU's in the Kearsarge pump station service area.

VIII. EXISTING FACILITIES – KEARSARGE PUMP STATION

A. Introduction

The Kearsarge pump station is located adjacent to Walnut Creek south of Zimmerly Road, and 400 ft. east of the juncture of 52nd Street and Zimmerly Road. It was constructed in 1958 and most recently modified in 1984. It receives flows from Millcreek Township south of the City (between Old Zuck Road and Clinton Streets). It also receives flows from the Summit Township Sewer system tributary to Route 19. The station and its tributary sewer network can be found on Figure SI-a / VIII-c found following page 15. Major interceptors are shown in red.

Approximately 20 to 25% of the flows received at the station come from Summit and 18% of the flows come from the areas north and west of the station. The remaining flows (55 to 60%) come from the areas in Millcreek, east and south of the station. Total drainage area to the Millcreek station from Millcreek is approximately 1,800 acres of which approximately 1,300 acres are tributary from the south and east. The majority of the area is residential with some institutional usage. However, there is a large commercial contribution consisting of some major water users (restaurants). There is over 200 acres of land devoted to commercial use.

Summit, likewise, has a large commercial contribution consisting of several heavy users [restaurants, hotels and recreational (theme parks)]. It's system also serves some older private sewer systems whose treatment plants were abandoned in favor of connecting to public sewers. Residential service due to newer construction, according to the Erie County Studies, has been relatively slow. The major growth impact has been the commercial growth along the Route 19 corridor.

The present station has a forward capacity under normal wet well levels of 3,600 gpm. This capacity is periodically exceeded. With operation of the third pump and wet well, surcharge flows can reach 3,800 gpm.

The station discharges to the MTSA's Pittsburgh Avenue sewer at 38th Street and its flows enter Erie City through the Manor Drive relief sewer (Pittsburgh connection). From there it reaches the Erie WWTP for treatment.

The Erie WWTP has a capacity of 68.6 MGD and averaged 41.9 MGD in 2003. It discharges to Lake Erie. Its permit effluent requirements are: BOD – 49 mg/l, SS – 70

mg/l, phosphorus – 1 mg/l, and coliform – 200 MPN (summer). The MTSA and Summit Township have agreements with the City and the Erie Sewer Authority for treatment of their wastes. The agreement allows MTSA peak discharges of 23.27 MGD at the Manor and Pittsburgh connection and it allows Summit 3.9 MGD. In 2003 MTSA flows averaged 10.5 MGD and Summit averaged .56 MGD. MTSA was notified in 2002 of three peaks recorded by Erie whose readings were greater than the agreement.

The MTSA abandoned the Kearsarge pump station gravity overflow in 1986. That overflow had been somewhat ineffective throughout the years since high waters often would prevent its use. As a result of the abandonment, the remaining gravity relief of the station in the event of overloading is at ground level. Long before this level is reached, basements will be flooded.

A diversionary overflow was placed on the force main from the station to allow the station forward pumping capacity to be increased by reducing friction loss in the force main. Flows continue to be passed forward to Erie and the treatment plant and just enough flows are bled off to allow the pumps to move sufficient flows to maintain or reduce station backups. Since 1992, twelve overflows of this type have been documented (three since August of 2003).

The PA DEP has placed the Millcreek Township Sewer Authority under a Consent Order (Appendix 5) to cease the use of the present system. Three general concepts are available to accomplish this goal. They are:

- Reduce influent flows
- Increase the pump station's forward flow capacity
- Divert flows above pump station capacity, store them, and bleed them back to the station once influent flows have been reduced below station capacity (overflow retention)

The Consent Order also requires that the sewer system be investigated to determine its capacity so as to eliminate the need to bypass pump in the system to protect from basement flooding. Three main interceptors enter the pump station and they were metered to determine flows so that the remaining capacity (either positive or negative) could be determined. The sewer extension into the area where flooding had been documented was also investigated. The alternatives available to accomplish this task are similar to those available for the pump station, except that overflow retention is not as attractive.

B. Discussion

The Kearsarge pump station's capacity is determined by any one of five factors. These include in reverse order of flow: downstream receiving capacity; force main; pump sizes; suction piping; station structure; and tributary sewer capacity.

The Kearsarge pump station flows have been reported in the Erie Chapter 94 Report based upon the metering equipment available at the station. This study's efforts have shown that equipment to be reading high. The Kearsarge station's average and peak flows given and corrected are found in the following table.

Kearsarge Pump Station
Flows (MGD)

	Average Flow		Peak Flow	
Year	Given	Corrected	Given	Corrected
2002	2.40	1.87	5.60	5.60 *
2003	3.10	2.42	7.20	7.20 **

* 2002 overflow event peak flow rate equaled 5.6 MGD
** In a 2003 overflow event peak flow rate equaled 7.2 MGD
The pump station capacity has been determined at: Pump #1 – 3,000 gpm (4.32 MGD); Pump #2 - 2,600 gpm (3.74 MGD); Pumps #1 and #2 – 3,600 gpm (5.2 MGD); Pumps #1, #2, and #3 – 3,800 gpm (5.5 MGD).

Downstream Gravity Receiving Capacity

Hydraulic capacity remains to receive additional flows from the Kearsarge station (16.9 MGD vs. 5.5 MGD existing peak), but presently Millcreek's total peak flows from all areas of Millcreek have been alleged to exceed agreement amounts with the City based on three events in 2002. Until the dispute is resolved, any increased pump station flows will aggravate the situation and increases in pumped forward flow should be kept to a minimum.

Force Main

The Kearsarge pump station force main carries flows from the station to the Pittsburgh Avenue interceptor which delivers the flow to the Manor Drive bypass connection to the Erie City collection and transportation network.

The force main is characterized by the schematic configuration found in Figure VIII-a. Its main characteristic is its ability to act as two different lengths of force main. At lower flows the head produced by the elevation difference between the high point at Grandview and the downstream sections is sufficient to pass the flows through the lower sections of the line (2,300 ft.) without the need for pumps (gravity). At higher flows the elevation head is insufficient and the pumps are needed to push flows through the entire equivalent length of pipe (7,000 ft.). Thus, system heads increase significantly at the higher rates.

KEARSARGE FORCE MAIN SCHEMATIC

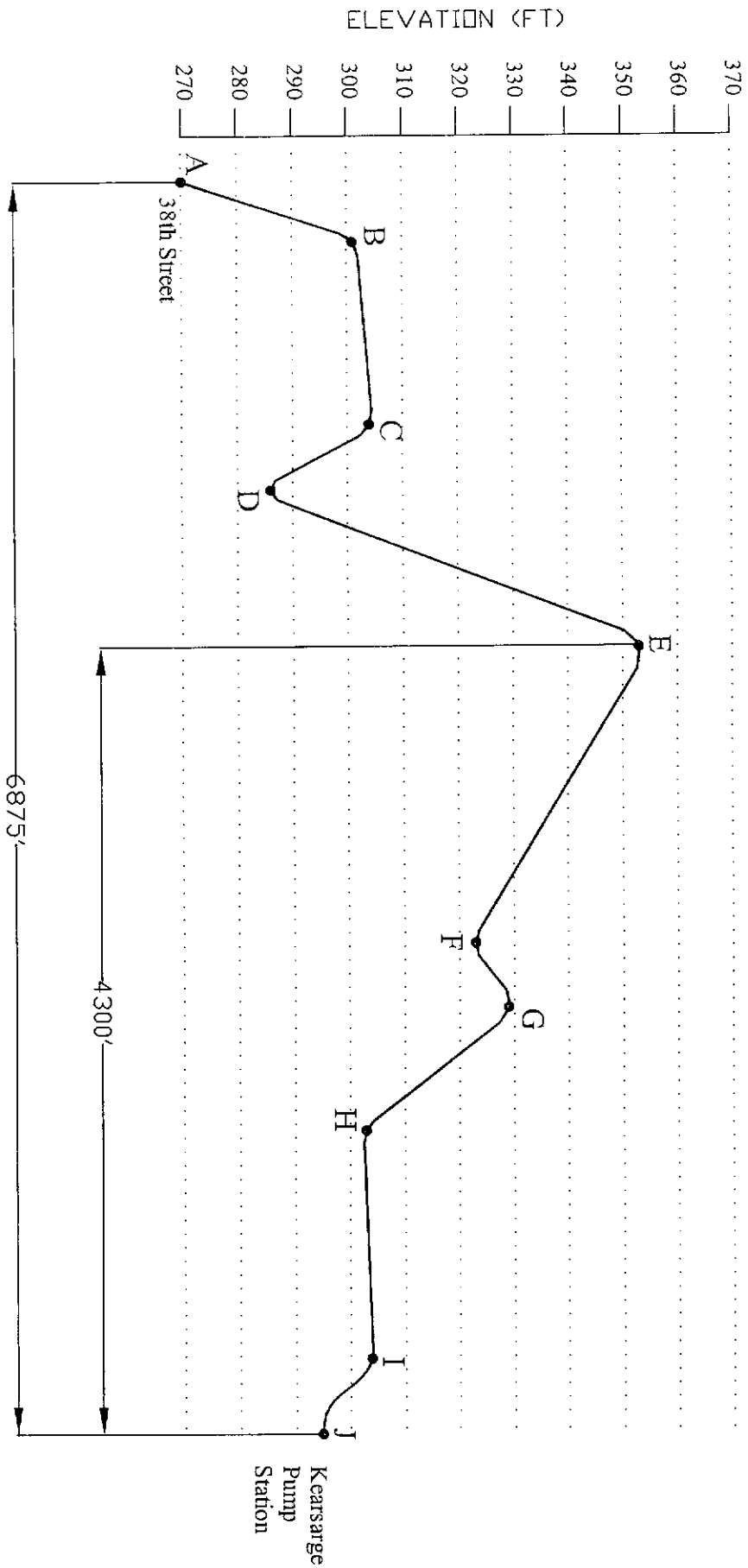


Figure VIII-a

Operation - It is difficult to ascertain exactly when the change in effective force main length occurs. The discharge head is relatively stable at flows below 3,150 gpm and above 3,750 gpm. They are unstable between 3,150 and 3,750 gpm varying more than 10 psi at times. This is caused by fluctuations in flow rates caused by increases in effective force main length. These variations are created by flow fluctuations created by pump speed variations and influent flow rate variations.
The flow/discharge pressure curve for the present force main was constructed by station observations and is found in Figure VIII-b. At flows of 3,150 gpm pressures approximate 39 psi and at 3,750 gpm they approximate 50 psi. At about 3,400 gpm pressures of 41 and 47 psi have been observed. Based on this observation, it is concluded that at flow rates of 3,400 gpm, the entire pipeline length is full.

Pipe Characterization - Using the observed flows and head losses the friction factor can be calculated for the force main. The equivalent length of the force main was calculated (accounting for fittings) at 4,700 ft. (low flows) and 7,000 ft. (high flows). Table VIII-1 gives the friction factor (C) calculated for the various flows. The C factor varies between 115 and 125 and 125 has been selected as the most representative.

As a check the C factor was calculated for 3,400 gpm (the presupposed transition point between a partially full and a full pipe). The C factors using the high and low observed head losses equaled 120 and 125 respectively which supports the presupposed transition point.

Table VIII-2 gives the anticipated head loss (friction plus static) for flows in excess of those observed (3,750 gpm) assuming both a full pipe its entire length and alteration of the pipe to allow its lower length to remain partially full at higher flows.

Pumps

Presently there are three pumps in the station. Pumps #1 and #2 are identical units and operate at variable speeds (below 1,200 rpm). They are driven by variable frequency drives. Their curves (Figure VIII-c) imply that they should be able to pump 2,000 gpm each at heads of 125 ft. (54 psi). Pump #3 is a 125 hp constant speed unit and has a flatter design curve. Although it can pump 2,000 gpm, it can only do so at low heads. When pump #3 is operating to support a single pump at 36 to 38 psi, it can only produce 600 gpm and when operating in conjunction with two pumps at 50 psi, its best output is 300 gpm. It is connected to the largest suction line (12-inch). The larger two pumps are connected to the wet well with 10-inch suction lines.

The present two pump operation appears to only produce 3,600 gpm (assumed 1,800 gpm each) at 50 psi. This could be due to excess suction losses, erroneous rpm's, or worn impellors. Pump #1 alone produces 3,000 gpm at 40 psi and 100% speed. Its curve implies it should reach 3,300 gpm. Suction losses have been checked and suction pressures of zero (0) were observed at 3,000 gpm (zero was assumed), discharge pressures double checked, and new impellors have been installed and cleaned. Rpm's have been checked, but given the accuracy of the measurements, it is believed this pump

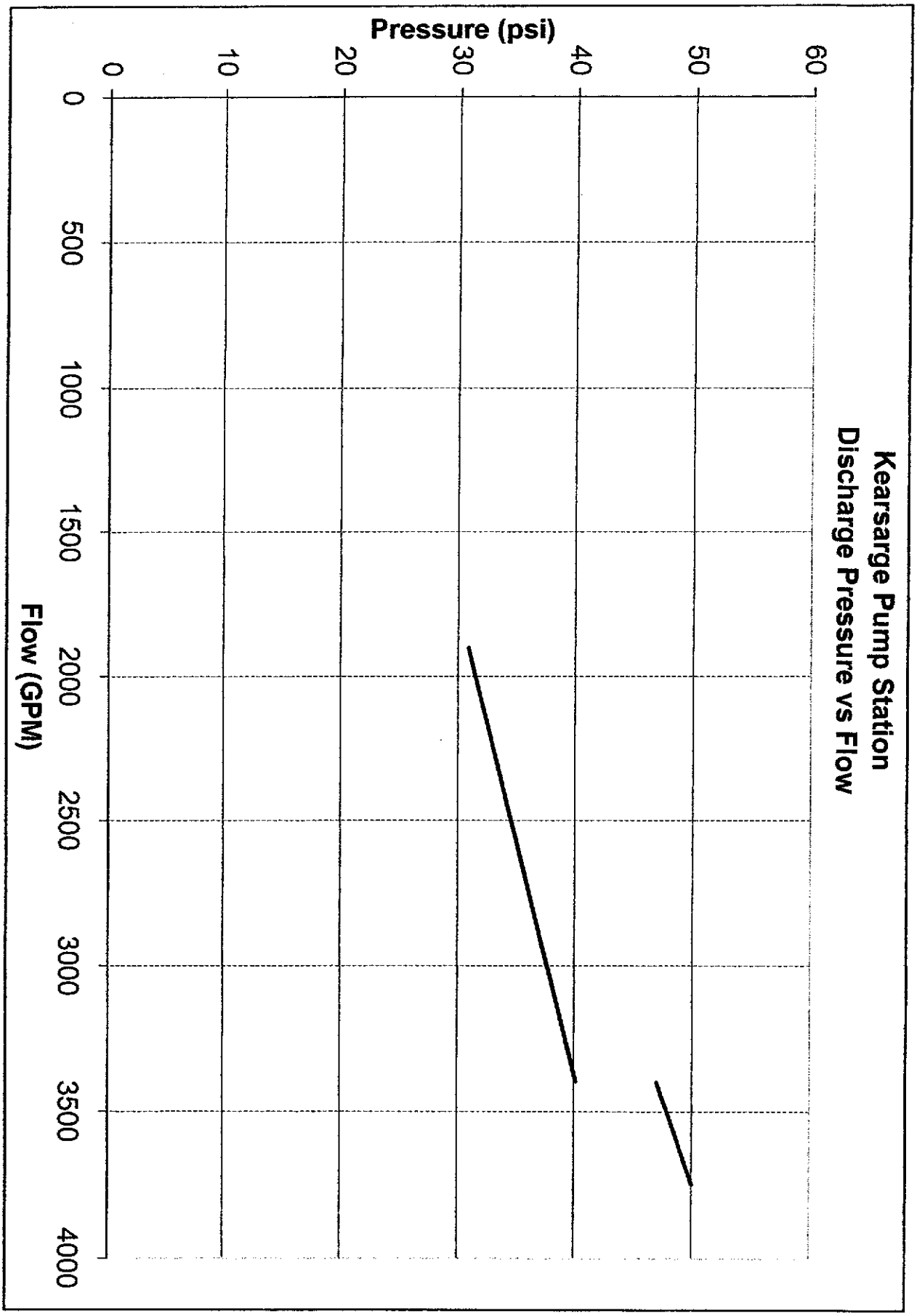


Figure VIII-b

MSA-MT 2191

TABLE VIII-1

HEADLOSS CALCULATION
VALUE OF C FOR KEARSARGE

Meter Q (gpm)	Adjusted Flow Q (gpm)	Adjusted Flow MGD	*Observed fH_L (T-S) (psi)	**Length w fix (ft.)	H_Lf ft./1000'	C
1,000	1,250	1.8	1	4,700	0.5	140
1,250	1,600	2.3	3	4,700	1.47	125
1,500	1,900	2.74	5	4,700	2.45	120
2,100	2,600	3.74	9	4,700	4.4	115
2,500	3,150	4.54	12	4,700	5.8	125
3,000	3,750	5.4	24	7,000	7.9	125
2,700	3,400	4.9	15	4,700	7.3	120
			21	7,000	6.9	125

* Static = 26 psi $fH_L = H_L - sH_L$ + @ ≈ 3,500 gpm line fills
** Fixture adjustment = 400 ft.

TABLE VIII-2

CALCULATED HEADLOSS (C = 125)
FLOWS > 3,750 D = 7,000 FT.

Q Adjusted	Q Meter	MGD Adj	H_L/1000	H_L (ft.) f	H_L (ft.) Total	*Pump Capacity (2 pumps)	16" Pipe & 10" Pipe V	ft./sec.
4,000	3,200	5.76	8.8	61	121	4,400	6.4	6.8
4,100					124	4,000		
4,500	3,600	6.48	11.0	77	137	2,800	7.2	9.0
5,000	4,200	7.20	13.3	93.1	153	0	8.0	
5,500	4,400	7.92	16.1	112	172	0	8.5	

* @ 0 NPSH (x 2 pumps) from curves
Best pumps can do is ≈ 4,000 + gpm 12" could handle
** 12 could reach 4.1 MGD or 2,800 gpm @ 8 ft./sec.

headlosskearsargeps.xl

TABLE VIII-3

CALCULATED HEADLOSS
FLOWS > 3,750 GPM d = 4,700 ft.

Q	Q Meter	MGD	H_L / 1,000	H_L (ft.) f	State	Total
4,000	3,200	5.76	8.8	41.36	60	101
4,500	3,600	6.48	11.0	51.70	60	112
5,000	4,200	7.20	13.3	62.50	60	123
5,500	4,400	7.92	16.1	62.50	60	136

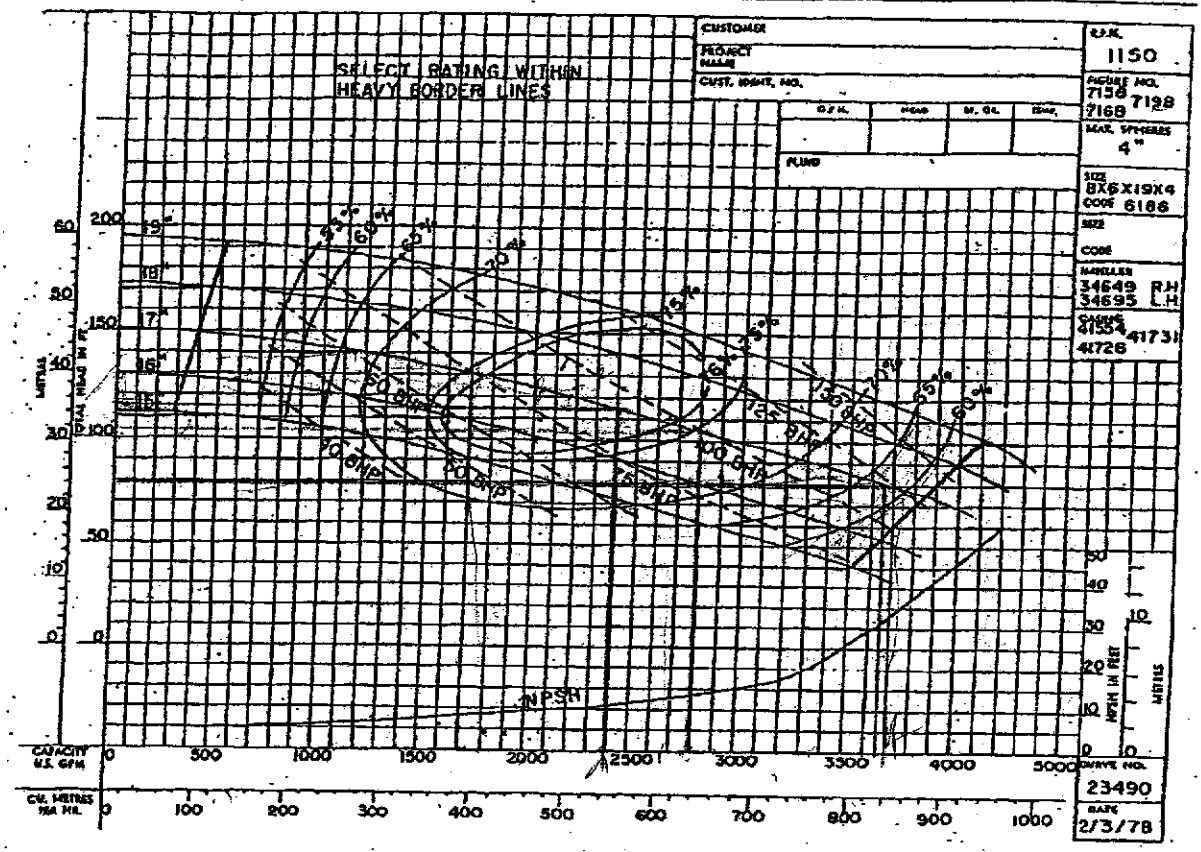
Motor – 1190

ANE-DEMING PUMPS
RANE CO.
SALEM, OHIO, U.S.A.

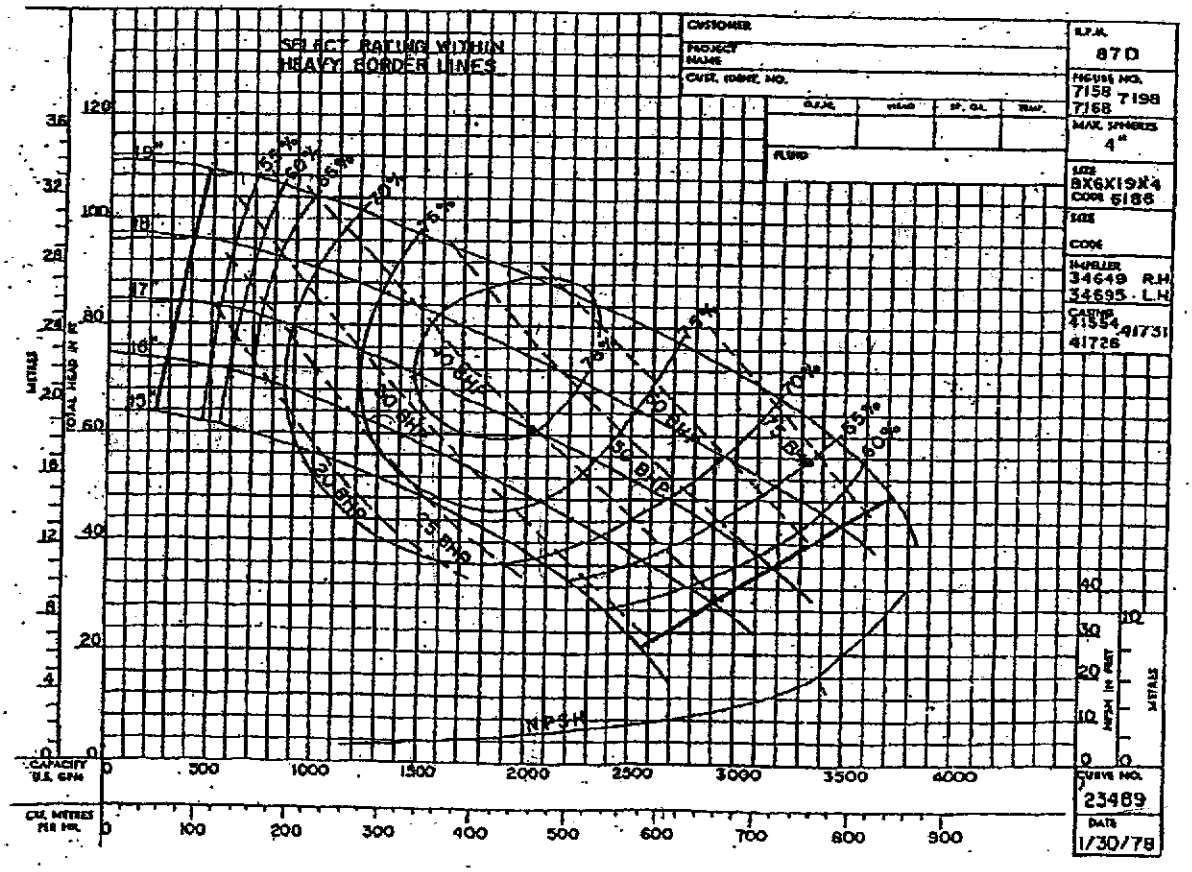
SECTION 45
DRY PIT SOLIDS HANDLING CENTRIFUGAL PUMPS
HORIZONTAL & VERTICAL — BULLETINS 7160, 7190

CURVE PAGE 45-13
DECEMBER 1979
SUPERSEDES SEPT. 1975

Customer _____ Cust. No. _____ Crane-Deming No. _____
Pump Data _____ Rating _____ GPM _____ Ft. _____ RPM _____ Data _____



CURVES SHOW PERFORMANCE WITH LIQUID HAVING SPECIFIC GRAVITY - 1.0, VISCOSITY - 30 SSU



17"

Figure VIII-c

Compare to C

is operating at close to optimum. Pump #2 only produced 2,600 gpm when operated alone (28 psi). It should have reached 3,400 to 3,500 gpm at that pressure. Its peak rpm is less than #1 and its suction may be restricted.

It is concluded that the present station capacity cannot be improved more than 500 gpm with the existing pumps. If all pumps were operating at peak efficiency, this still would have been insufficient to have prevented the overflow on March 20, 2004, or the one in September, 2003, when it is estimated that average influent flows exceeded pump station capacity by 580 gpm over 2-1/2 hours and 1,200 gpm over five hours respectively.

Suction Piping

Presently the Kearsarge pump station pumps are all served with their own suction piping. Two of the three pipes are 10-inch diameter and they serve the existing 100 hp variable speed pumps. The third suction is a 12-inch line and it serves the constant speed 125 hp pump. At peak speed operating independently, pump #1 discharges approximately 3,000 gpm and pump #2 discharges approximately 2,600 gpm pumping alone at top speed. At 3,000 gpm the observed suction pressures were 2 psi with a suction head of 8 ft. and 0 psi with a suction head of 4 ft. (Table VIII-3, "Suction Heads Observations & Calculations") Theoretically at a friction factor of 120 and adjusting for the inlet and gate valve losses the suction pressures should have been 2.7 and 1.0 psi indicating a difference of 0.7 to 1.0 psi over theoretical. This may be due to a pipeline restriction. However, observations on May 21st with total flows of 4,500 gpm (overflow active) suction pressures were equal at 5 psi with suction heads of 16 ft. or 7 psi. This again equals a suction loss of 2 psi. It is assumed that pump #2's pumping volume is slightly less than pump #1's and thus its suction restriction may be slightly more.

The capacity difference is concluded to be due to lesser rpm's. The rpm's of pump #2 at 100%, has been shown to be slightly less than pump #1.

Flows in excess of 3,000 gpm are not believed advisable in the 10-inch suction. Velocities at that rate equal 12 ft./second, almost double the recommended values and even this value normally would not be recommended if actual practice had not shown it to be possible.

Table VIII-3

Suction Pipe Entry Losses Calculations
10" @ 3,000 gpm (4.3 MGD)

Pipe Length: 10 ft. $c \approx 120$
Gate Valve Equiv. Length: 7
Entry Equiv. Length: 16
33 ft.

Theoretical 54 ft./1000 = 5.40 ft./100 = 1.8 ft./33 ft.
= 0.78 psi /33 ft.

Observed Suction (Gary Snyder)
2,300 gpm $\approx$ 28,500 $\approx$ 4.1 MGD
@ beam = 2 psi Top Beam 299 – Elev
@ Normal = 0 psi Normal Level 295 – Elev

Pump Suction @ 291' Elevation

Suction Pressure Theoretical
@ beam 299 – 291 – 1.8 = 6.2/2.3 $\approx$ 2.7 psi
@ Normal 295 – 291 – 1.8 = 2.2/2.3 $\approx$ 0.96 psi

Actual Suction Loss in Excess of Theoretical = 0.7 to 0.96 psi

Influent Sewers

The station receives flows from three areas defined by separate sewers. From the north and west a 10-inch conveys the waste easterly along Zimmerly (Zimmerly sewer) to a juncture with an 18-inch conveying the waste from Millcreek to the east and south of the station and from Summit's connection on Edinboro Road (Beaver Run and Rt. 19 sewer). The 18-inch then discharges to the pump station 25 ft.$\pm$ further downstream. A third pipe, a 24-inch, discharges directly to the pump station along side the 18-inch. The 24-inch presently accepts flows from Summit Township's Route 19 access point and it is located on mostly mall property (Mall sewer). The three sewers are shown on attached Figure SI-a / VIII-d.

The influent sewer sizes, slopes, and capacities are given in Table VIII-4. The sewers have been monitored over the past six months. The results of that monitoring are found in Figure S-b / VIII-d and summarized in Table VIII-5 / XIII-1. The 18-inch upstream of its juncture with the 10-inch carries the most flow approximately 60% of the flow reaching the pump station. The 10-inch carries approximately 18% and the 24-inch 22%.

FIGURE SI-a/VIII-d

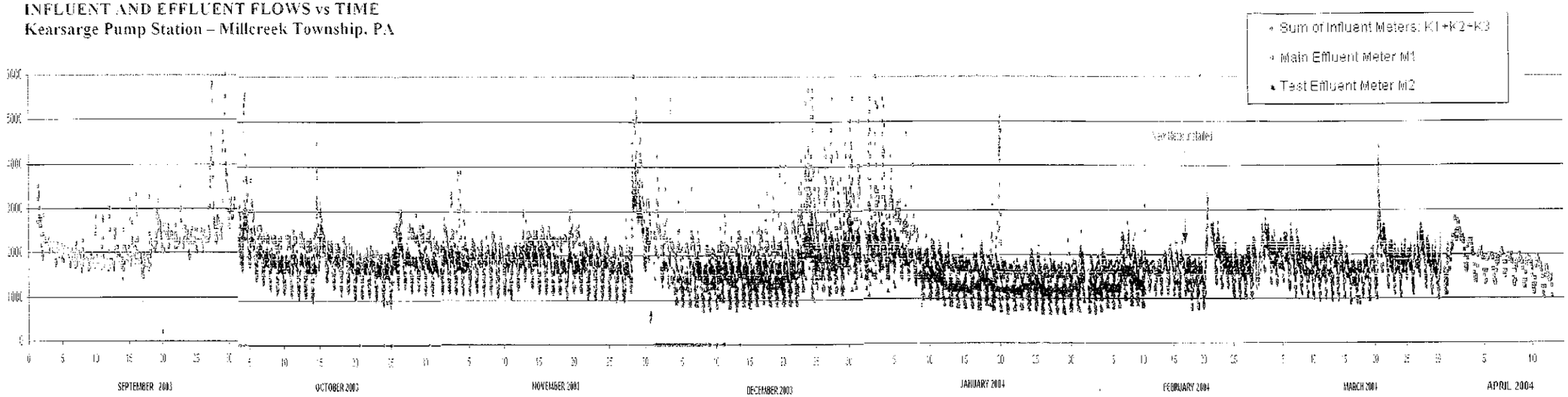
TABLE VIII-4

KEARSARGE PUMP STATION
TRIBUTARY SEWER CAPACITY

GIVEN Pipe Size (in) Slope (ft./ft.)			CALCULATED Flow Velocity		
	PIPE SIZE	SLOPE	FLOW		
LOC			MGD	GPM	CFS
K1	10	0.028	0.65	451	1.0
K2	18	0.004	4.2941	2982	6.6
K3	24	0.0065	10.0	6945	15.0
K4	12	0.0022	1.0801	750	1.7

Note: Flow calculated based on known pipe diameter and slope.
Assumptions: Full Pipe
Manning n = 0.013

INFLUENT AND EFFLUENT FLOWS vs TIME
Kearsarge Pump Station – Millcreek Township, PA



INFLUENT METER READINGS vs TIME
Kearsarge Pump Station – Millcreek Township, PA

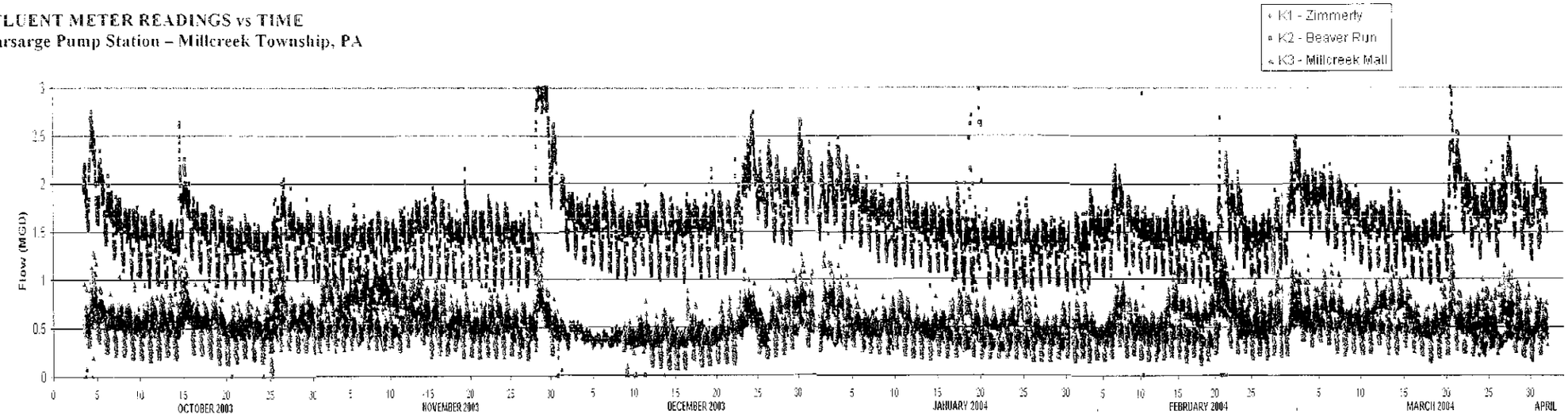


Figure 5-b/VIII-a

App. 246

MSA-MT 2199

Case 1:05-cv-00059-MBC Document 38-6 Filed 03/31/2006 Page 46 of 50

TABLE VIII-5 / XIII-1

COMPARISON OF KEARSARGE METERS

	OCT '03 %	NOV '03 %	DEC '03 %	JAN '04 %	FEB '04 %	MAR '04 %	APR '04 %	AVG %
K1 as a % of ∑K (10")								
All Dates	20	18	17	16	18	17		
High Flow	22	16	18	-	16 & 20	18		
K2 as a % of ∑K (18")								
All Dates	58	58	63	62	59	62		60.3
High Flow	57	67	64	-	61 & 50	63		60.3
K3 as a % of ∑K (24')								
All Dates	22	24	BAD	21	22	21		22
High Flows	22	18	DATA	-	22 & 25	19		21.2
S1 as a % of ∑K								
All Dates	22	22	23	22	25	25		23.2
High Flow	21	24	23	-	22 & 29	25		24
K3 as a % of S1								
All Dates	102	107	BAD	96	90	85		96
High Flow	102	75	DATA	-	99 & 85	76		87.4
From Plots	99	102		94	88	84		93.4
K4 as a % of K2								
All Dates	18	17	18	17	17	17		17.3
High Flows	18	23	21	-	18	26		21.2

Note: K1 - Zimmerly Road Sewer
K2 - Beaver Run Sewer
K3 - Mall Sewer
K4 - Beaver Run Extension
S-1 - Summit Meter

comparisonofkearsargemeters.xl

There is little difference in the percentages of flow carried by the pipes under dry or storm flow influences witnessed in the months observed. There was less than a 1% variation between the average wet weather vs. normal weather flows for any pipe over the six-month period.

The capacities and the estimated loadings of the three tributary sewers and the 12-inch extension of the Beaver Run interceptor are given in Table S-7 / VIII-6.

18-inch (Beaver Run Interceptor):

The 18-inch pipe flow peaks varied between 3.5 MGD and 1.7 MGD during the recent observations. Its slope is 0.004 ft./ft. Its capacity equals 4.3 MGD. If its percentage remains the same for flows from a design storm during wet conditions with a repeat frequency of one year, its flows will equal 5.5 MGD. At present all growth in Millcreek south and east of the station and in Summit along Edinboro Road will enter this sewer adding to the ultimate flow expected. Millcreek's growth of .113 MGD average or 0.282 MGD peak will cause the total expected peak flow to reach 5.8 MGD. At 5.8 MGD a slope of 0.0075 would be needed in the 18-inch. This will lead to a surcharge of 3.5 ft. over every 1,000 foot of its length. Figure S-c / VIII-e) shows this relationship. Flows will need to be diverted or a relief sewer constructed unless the I&I efforts are very successful.

If a 50 to 25-year frequency storm is assumed during a saturated soil condition, as much as 6.4 MGD could be found in the 18-inch (this would add an additional 1.5 ft. of surcharge every 1,000 ft.). An overflow will occur in this case from manholes east of Peach Street and west of Washington.

Also, any surcharge in the pump station wet well above the inlet sewers invert (9.5 ft. above pump suction centerline) will add directly to any surcharge.

Finally, Summit has stated that as much as 1.3 MGD of their 3.9 MGD ultimate flow could originate on Edinboro Road and thus be tributary to this sewer via Millcreek's southern Peach Street sewer. This would increase the required slope of the 18-inch to 0.011 and add 3.5 ft. per thousand feet to the surcharge (surface at Peach Street).

Millcreek's South Peach Street Sewer

This sewer collects sewage from areas tributary to Peach Street south of Beaver Run and discharges that flow to the 18-inch Beaver Run interceptor. Flows include sewage from Interchange Road and Edinboro Road (Rt. 99) which includes Summit flows. Summit purchased 1.3 MGD of capacity in the Edinboro Road sewer. However, the Interchange Road sewer was an earlier construction. It has adequate capacity for the anticipated 2014 flows but may not have sufficient capacity for ultimate flows. The present minimum capacity of the Millcreek southern Peach Street sewer equals 2.99 MGD between Interchange Road and Walnut Creek and 1.63 MGD across Interchange Road. Interchange Road's sewer capacity equals 1.45 MGD. Thus, with Millcreek's full

TABLE S-7 / VIII-6
TRIBUTARY INTERCEPTOR CAPACITIES

Year	Interceptor	Total (MGD)	10" (MGD)	18" (MGD)	24" (MGD)	12" (MGD)
2004	Capacity	N/A	0.65	4.30	10.00	1.08
	Base Storm Flow	6.9	1.24	4.14	1.52	0.87
	1-Yr. Storm	9.2	1.66	5.52	2.02	1.16
	25-Yr. Storm	10.2	1.84	6.12	2.24	1.35
2014	Base Storm	7.7	1.43	4.33	1.98	0.87
	1-Yr. Storm	9.8	1.85	5.64	2.48	1.16
	25-Yr. Storm	10.8	2.03	6.24	2.70	1.35
Ultimate	Base Storm	8.8	1.46	4.50	3.22	0.87
	1-Yr. Storm	11.0	1.88	5.81	3.62	1.16
	25-Yr. Storm	12.0	2.06	6.41	3.84	1.35

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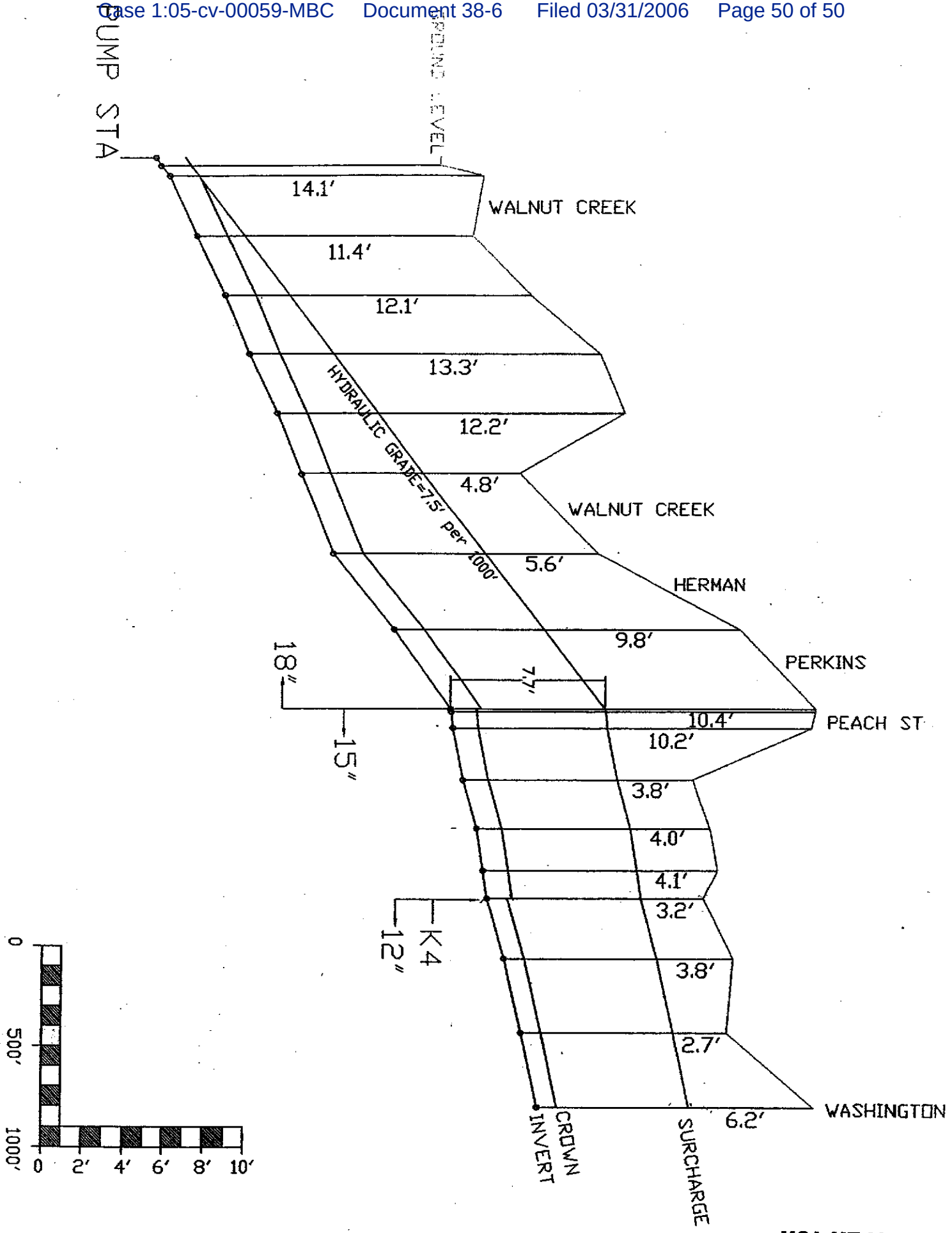

FIGURE S-c / VIII-e

MSA-MT 2203

App. 250